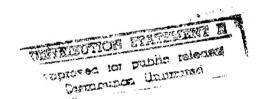
# **CORPS OF ENGINEERS**

Limited Energy Study
Thermal Storage at
Central Chilled Water Plant
Fort Leonard Wood, Missouri

# FINAL SUBMITTAL

May 31, 1996



Kuhlmann Design Group, Inc. 66 Progress Parkway Maryland Heights, MO 63043 314.434.8898

KDG Project No. 930073-0017

BASE CASE CENTRIFUGAL CHILLER PAGES 1,2,3 & 4 WERE INTENTIONALLY NOT INCLUDED IN THE REPORT

ECO IH-1 PAGES 4,8 & 12 WERE INTENTIONALLY LEFT BLANK

ECO IT-2 PAGES 4,8 & 12
WERE INTENTIONALLY LEFT BLANK

PER: MARY OHMEYER (314) 434-8898

KUHLMANN DESIGN GROUP, INC. ST LOUIS, MO.

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# COE LIMITED ENERGY STUDY THERMAL STORAGE AT CENTRAL CHILLED WATER PLANT FORT LEONARD WOOD, MISSOURI 930073-0017

May 31, 1996

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# **SECTION 1**

# **EXECUTIVE SUMMARY**

# A. Introduction

The Scope of Work (See Appendix A) called for the study of the economic feasibility of providing a cold thermal storage system at the central chiller plant serving the Fort Leonard Wood 600 Area in order to reduce electrical demand charges.

In the Entry Interview, Mr. Doug Cage requested that the analysis include the potential for expansion of such a system to serve the 700 and 800 Areas as well. It was agreed that this would be done if the analysis indicated that a cold thermal storage system would be economically feasible for Area 600. Essentially, the systems are modular in nature, so that installed costs would be a multiple of the number of Areas served, not including any extraordinary costs which might be incurred as a result of special conditions which might be encountered as a result of system expansion.

# B. Building Data

The 600 Area study area is comprised of two different build types, mess halls and barracks. The mess halls are all essentially identical with the exception that site orientation varies by building. The same is true for the barracks buildings. The following table summarizes building data.

BUILDING TYPE	QUANTITY	FLOOR AREA EACH
Barracks	10	25,878 sq.ft.
Mess Hall	4	7,140 sq.ft.

# C. Present Energy Consumption and Demand

A baseline case was calculated under the basis that the future chilled water plant for the area under analysis would be served by a centrifugal chiller. this was done because there is no existing baseline condition against which thermal storage systems may be compared. The existing chiller serves Area 600 plus a portion of Area 700. In addition, its age is such that it is reasonable to expect that it will be replaced in the near future. Assuming that replacement would be done by centrifugals is, we believe, both reasonable and proper.

Electrical energy and demand data for this "Base Case" are as follows:

Peak electrical demand:

679 KWD

Peak energy demand:

2,317,000 BTUH

Annual demand charge costs: \$50,395

Annual electrical usage:

1,436,000 KWHR

Annual energy usage:

4,900,000,000 BTU

Annual energy cost:

\$35,895

Total annual utility cost =

\$86,290

(demand plus usage)

No fuels other than electricity are involved in this study.

# D. Energy Conservation Analysis

# 1) ECO's Investigated

There are two main approaches to cold thermal storage, and both of these were evaluated. One approach uses what is termed an "ice-harvesting" or "ice-shucking" approach, in which thin layers of ice are cyclically built-up on vertical plates and dropped off into a bin below. This bin of ice chips then becomes the means of providing chilled water. The other approach will typically freeze ice in a solid block, perhaps around a bank of pipes during the ice building phase. At the end of the ice building phase, the pipes will circulate water through them which gradually melts the build-up ice, and simultaneously chills the water passing through them. We have referred to these systems as "ice tanks."

The ice harvesting system has the benefit of being able to simultaneously provide chilled water while it continues to build ice. No separate ice-build time is needed. The ice tank system cannot do this. Therefore, for buildings which require cooling at night (such as the Barracks), a separate conventional chiller is required for this duty so that the ice tanks can recharge. The cost and effect of this extra chiller has been included in ice tank calculations.

For each system several combinations of chiller"run"/chiller"off" hours over a 24 hour day were evaluated. Each combination became a separate ECO. Such combinations result in variations in thermal storage volume requirements, chiller plant tonnages needed, and energy consumption. These combinations were generated in order to arrive at the optimum for both first cost and energy consumption.

# ICE HARVESTING SYSTEMS

Appendix C contains manufacturer's literature for a typical ice harvesting system. Five alternative systems were evaluated, utilizing various combinations of run time vs. off times, and in addition varying the amount of time the systems ran making ice to the amount of time they ran as conventional chillers. The five systems analyzed are summarized in the following table.

HOURS MAKING ICE	HOURS AS CHILLER	HOURS "OFF"
8	16	0
8	10	6
12	12	0
12	6	6
8	13	3
	MAKING ICE  8 8 12	MAKING ICE         CHILLER           8         16           8         10           12         12

The ice harvesting system has the ability to continue to produce chilled water during the hours it is in the ice-making mode, due to the fact that the generated ice is de-coupled from the ice-making apparatus. It is therefore available as a separate chilling source. Therefore, the columns labeled as "hours making ice" should not be interpreted as though chilled water cannot be produced during those hours. It simply means that the mechanical refrigeration system will be making ice during those periods.

# ICE TANK SYSTEMS

Appendix C contains manufacturer's literature for a typical ice tank system. As with the ice harvesting systems, a total of five alternative systems were evaluated with different mixed of chilling, ice-building, and off hours over a 24-hour period. The following table summarizes these combinations:

ECO#	HOURS MAKING ICE	HOURS AS CHILLER	HOURS "OFF"
IT-1	8	16	0
IT-2	11	13	0
IT-3	8	10	6
IT-4	11	7	6
IT-5	11	10	3

# 2) ECO's Recommended

None of the ECO's can be recommended.

# 3) ECO's Rejected

None of the ECO's met the required SIR hurdle of 1.25 and therefore all ECO's are rejected. The conclusion is that cold thermal storage is a non-feasible approach to reducing utility costs at Fort Leonard Wood. The reasons for this are very basic.

First, cold thermal storage systems are extremely expensive to install, compared to

conventional chilled water generators such as centrifugal chillers. The difference in first costs can be amortized over a reasonable period of time, but only if demand and energy charges avoided are high, such as exist on the east coast of the United States. However, the rates being charged at Fort Leonard Wood are among the lowest in the country. The table on page 3-3 from the 7/95 issue of Energy User News reflects this. It shows that, at the current rate of 2.50 cents per KWHR, had Ft. Leonard Wood's utility company been included in this list it would have been one of the cheapest rates in the country, ranking in the top 2.5% of those listed. While this table reflects energy charges only, it is generally the case that energy rates and demand rates go hand-in-hand. Such systems can also be made feasible if the local utility has financing or cash contribution incentives which can be applied against first costs. However, the local utility has no such programs available.

A contributing factor which hurts the viability of cold thermal storage is the need to have cooling available at night for the Barracks building. Most cold thermal storage systems are successfully employed only on buildings which have a regular "down time" such as office buildings, which are closed at nights and over weekends. Such downtime allows the ice system to devote itself exclusively to re-charging of the ice tanks, without the need to simultaneously provide cooling. A need for concurrent cooling drives the installed cost of the system up very significantly.

# 4) ECIP Projects Developed

None. See Table 1.1 at end of this Section.

# 5) Non-ECIP Projects Developed

None. See Table 1.1 at the end of this Section.

# 6) Operational or Policy Change Recommendations

None. Thermal storage is not economically attractive for Fort Leonard Wood.

# E. Energy and Cost Savings

See Table 1.2 at end of this Section.

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# LIFE CYCLE COST ANALYSIS SUMMARY

		ANNUAL	ANNUAL		SIMPLE	
		ENERGY	COST		PAYBACK	ANALYSIS
ECO	COST(\$)	SAVINGS*	SAVINGS**	SIR	PERIOD(YRS)	DATE
IH-1	948,394	11.3	\$ 9,485	.15	66.66	8/21/95
IH-2	2,231,477	-209.9	\$43,070	.28	51.81	8/21/95
IH-3	938,656	- 15.2	\$ 9,500	.14	102.91	8/21/95
IH-4	1,174,666	-216.8	\$42,898	.54	27.38	8/21/95
IH-5	1,067,969	- 54.4	\$46,956	.65	22.74	8/21/95
IT-1	536,849	11.3	\$15,200	.42	35.32	8/21/95
IT-2	648,009	74.1	\$19,963	.46	32.46	8/21/95
IT-3	1,048,431	9.4	\$48,552	69:	21.59	8/21/95
IT-4	968,714	41.6	\$49,356	.76	19.63	8/21/95
IT-5	759,010	50.3	\$49,574	.97	15.31	8/21/96

<sup>\*</sup> Savings are in units of thousand of watt-hrs per year.

<sup>\*\*</sup> Includes savings due to electrical demand charge avoidance.

ENERGY USE AFTER IMPLEMENTATION*	28490	52914	28120	33052	29804	28490	27234	28528	27884	27710
<b>□</b>										
ENERGY USE BEFORE IMPLEMENTATION*	28716	01/87	28716	28716	28716	28716	28716	28716	28716	28716
PERCENTAGE OF ENERGY CONSERVED	%8.0	-14.6%	-1.1%	-15.1%	-3.8%	0.8%	5.2%	0.7%	2.9%	3.5%
TOTAL POTENTIAL COST SAVINGS**	\$141,412	\$635,640	\$135,338	\$632,896	\$697,342	\$226,452	\$298,903	\$722,684	\$735,463	\$738,911
TOTAL POTENTIAL ENERGY SAVINGS*	226	-4198	-304	-4336	-1088	226	1482	188	832	1006
ECO	IH-1	IH-2	IH-3	IH-4	IH-5	IT-1	IT-2	IT-3	IT-4	IT-5

# TABLE 1.2

# ENERGY AND COST SAVINGS SUMMARY

(Note: Negative numbers indicate that ECO consumed more energy than base case.)

<sup>\*</sup> Units are in thousand of watt-hour. \*\* Includes savings due to electrical demand charge avoidance.

# **SECTION 2**

# METHODS USED AND SOURCES OF INFORMATION

The Scope of Work (See Appendix A) called for the study of the economic feasibility of providing a cold thermal storage system at the central chiller plant serving the 600 Area in order to reduce electrical demand charges.

In the Entry Interview, Mr. Doug Cage requested that the analysis include the potential for expansion of such a system to serve the 700 and 800 Areas as well. It was agreed that this would be done if the analysis indicated that a cold thermal storage system would be economically feasible for Area 600. Essentially, the systems are modular in nature, so that installed costs would be a multiple of the number of Areas served, not including any extraordinary costs which might be incurred as a result of special conditions which might be encountered as a result of system expansion.

The areas in question are comprised of multiples of two different building types, Mess Halls and Enlisted Men Two-Company Barracks. Architectural drawings were obtained for these buildings and each building type was entered into the Trane "Trace 600" computer program in order to determine the building's daily cooling load profiles. Buildings were entered for each of the three Areas, in their proper quantity and orientation. In order to establish daily cooling load profiles, load curves were estimated for the two building types for both lighting and occupancy. The major factor in determining daily cooling load profiles, however, was skin loading due to shifting solar loads and varying outside air temperature.

Load profiles were then applied to several different potential types of central chiller plants (ECO's) each with their own capacities, efficiencies, and run time periods. Applying these loads to each system was done through the "Trace 600" program, and resulted in the calculation of energy usages over the cooling season.

There are two main approaches to cold thermal storage, and both of these were evaluated. One approach uses what is termed an "ice-harvesting" or "ice-shucking" approach, in which thin layers of ice are cyclically built-up on vertical plates and dropped off into a bin below. This bin of ice ships then becomes the means of providing chilled water. The other approach will typically freeze ice in a solid block, perhaps around a bank of pipes during the ice building phase. At the end of the ice building phase, the pipes will circulate water through them which gradually melts the built-up ice, and simultaneously chills the water passing through them. We have referred to these systems as "ice tanks".

The ice harvesting system has the benefit of being able to simultaneously provide chilled water while it continues to build ice. No separate ice-build time is needed. The ice tank system cannot do this. Therefore, for buildings which require cooling at night (such as the Barracks), a separate conventional chiller is required for this duty so that the ice tanks can recharge. The cost and effect of this extra chiller was included in ice tank calculations.

In addition, for each system several combinations of chiller "run"/chiller "off" hours over a 24 hour day were evaluated. Such combinations result in variations in thermal storage volume requirements, chiller plant

tonnages need, and energy consumption. These combinations were generated in order to arrive at the optimum for both first cost and energy consumption.

Finally a baseline case was calculated under the basis that the future chilled water plant for the area under analysis would be served by centrifugal chiller. This was done because there in no valid existing baseline condition against which the thermal storage systems may be compared. The existing chiller serves only Area 600 and a portion of Area 700. In addition, its age is such that it is reasonable to expect that it will be replaced in the near future. Assuming that replacement would be done by centrifugals is, we believe, both reasonable and proper.

The energy and demand rates used in our cost calculations were those incremental rates which the Fort would fall under assuming no change in other normal daily summer base electrical usage. These figures were obtained directly from the electric utility company which serves the base.

Implementation cost estimates have been prepared for each ECO. Sources of cost estimate data include vendors of the various system types being analyzed and the most recent issues of the electrical and mechanical copies of the R.S. Mean Estimating Guidelines.

All load and energy consumption calculations were performed using the Trane "TRACE 600" program. The TRACE program is a professionally recognized and proven computer program that integrates architectural features with heating systems. It is capable of simulating the features, systems, and thermal loads of the building components under study. It uses NOAA weather data files and performs calculations by condensing those files into several "typical" days per month.

Cost estimates were generated through use of schematic design layouts, quotes from vendors and manufacturers for significant pieces of equipment or services, and the 1995 copies of the Means' Estimating Cost Data books.

Life cycle cost calculations were performed using the LCCID program as stipulated in the General Scope of Work.

We were informed that the chilled water plant is typically brought on in mid-May and is left on-line until mid-September. The TRACE program does not have a means of scheduling equipment run periods from mid-month to mid-month, and so the four month period of June through September was used for all calculations.

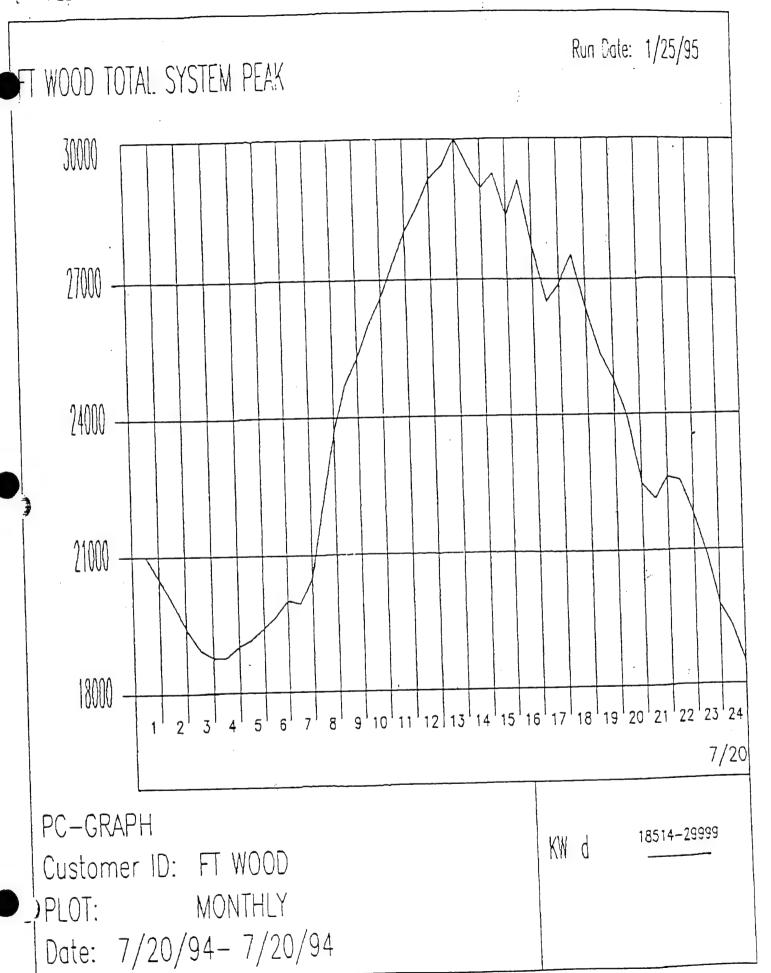
Regarding total personnel occupancies, the analysis used the scenario in which all barracks were staffed to their design capabilities, assuming a period of major required readiness. This was done also for the mess halls. During the course of a typical day, population within the barracks was allowed to fluctuate, assuming a large part of the building remained occupied due to the classrooms contained therein. Mess halls were generally left unoccupied except for the regular scheduled eating hours during which design occupancies were used.

As stated earlier, there were several points to be considered when deciding what system configurations should be evaluated.

The most important consideration is the avoidance of incurring electrical demand charges. Since the concern is to avoid establishing new high demand levels, the key point is that chiller plant demand will only be an issue during that time of the day (mid-afternoon) when total Fort electrical demand is at its highest. Therefore, not running chillers and their required auxiliary motors (such as cooling tower fans and condenser pumps) during these hours can be very beneficial. A curve of historical peak Fort electrical demand was obtained from the utility and became the basis for estimating those hours for chiller "off" times which would be of value. A copy of this demand curve is on the next page.

Another consideration involved how many hours of the day the system will run in the ice-making mode compared to how long it will run in the normal chiller mode, and whether it will be turned off during the peak demand hours of mid-afternoon. The longer it is "off", the more ice-storage capacity which must be designed into the project. On the other hand, if the amount of ice storage is reduced, the cooling capacity of the chiller will be driven upward in order to supplement the thermal capacity of the stored ice. Again, this drives up first cost.

In conclusion, there is no simple means of determining which (if any) combination of run times, off periods, and thermal storage capacities is the "best". It involves a multiple run cut-and-try approach. This is what was done in both the ice harvesting and ice tank systems. Please refer to Appendix B for a detailed discussion of how this procedure was carried out.



# **SECTION 3**

# RESULTS

Appendix G contains the conceptual cost estimates for each of the ECO's and the Base Case. Equipment sizes were determined from the cooling load calculations and costs were obtained from sales engineers representing manufacturers. Installation costs were taken from the 1995 Means Estimating Guides, and allowances were made for associated materials such as piping and insulation. In addition, costs were factored in for associated work and burdens such as controls, balancing, and project manuals and start-up. Markup rates of 10% for overhead and profit and 15% for contingencies were added to estimate totals.

The LCCID program approaches this type of project by comparing ECO costs to ECO savings. As a result, since this is in effect a replacement project, data was entered for each of the ECO's by entering the difference in construction costs between the ECO and the Base Case as the ECO cost, and the utility cost difference between the ECO and the Base Case as the ECO savings. An economic life of 20 years was used for the analysis.

Utility costs entered were taken directly from the ICO utility cost summaries tabulated in Appendix E. No meaningful non-energy recurring or non-recurring costs are anticipated that would be distinguishable between any of the ECO's and the Base Case.

The resulting LCC Analysis Printouts for the 10 ECO's are presented in Appendix H, and are summarized below:

ECO	Total Investment*	Total Discounted <u>Savings</u>	Simple Payback <u>Period (Yrs)</u>	SIR	Adjusted <u>I.R.R.</u>
IH-1	\$ 948,394	\$ 141,412	99.99	.15	-6.35
IH-2	2,231,477	635,640	51.81	.28	-3.27
IH-3	938,656	135,338	102.91	.14	-6.51
IH-4	1,174,666	632,896	27.38	.54	14
IH-5	1,067,969	697,342	22.74	.65	.83
IT-1	536,849	226,452	35.32	.42	-1.35
IT-2	648,009 (1,048,431 968,714	298,903	32.46	.46	91
IT-3		722,684	21.59	.69	1.10
IT-4		735,463	19.63	.76	1.59
IT-5	759,010	738,911	15.31	.97	2.86

<sup>\*</sup>Compared to Base Case

As can be seen, none of the ECO's meet the required SIR hurdle of 1.25, including the "optimized" cases. The conclusion is that cold thermal storage is a non-feasible approach to reducing utility costs at Fort Leonard Wood. The reasons for this are very basic.

First, cold thermal storage systems are extremely expensive to install, compared to conventional chilled water generators such as centrifugal chillers. The difference in first costs can be amortized over a reasonable period of time, but only if demand and energy charges avoided are high, such as exist on the east coast of the United States. However, the rates being charged at Fort Leonard Wood are among the lowest in the country. The accompanying table, from the 7/95 issue of Energy User News, reflects this. It shows that, at the current rate of 2.50 cents per KWHR, had Ft. Leonard Wood's utility company been included in this list it would have been one of the cheapest rates in the country, ranking in the top 2.5% of those listed. While this table reflects energy charges only, it is generally the case that energy rates and demand rates go hand-in-hand. Such systems can also be made feasible if the local utility has financing or cash contribution incentives which can be applied against first costs. However, the local utility has no such programs available.

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R	A	V	1	M	G	N	3	31	E	H	R	C	11	7	P	R	T	B	3
		м	$\mathbf{L}$					7 -	ו דו	14		1.1					Ι.		• 4

# INDUSTRIAL

Rack	Cts/kws		UTILITY	Cum kwh	Rank	Cts/kwh		עדונודע	Cam kwh
1. 2	12.71	Hi	Hawaii Elec. Light	0.0%	86. 97	4.40	De	Delmarva P&L	47.3%
3.	10.86	. Hi	Consolidated Edison Maui Electric	0.1%	87. 88.	4.36 4.34	Fl Min	Gulf Power	47.5%
4.	9.98	NH	P.S. New Hampshire	0.4%	89.	4.34	ND	Northern States Power Northern States Power	49.4%
5.	9.82	Ma	Commonwealth Elec.	- 0.4%	90.	4.32	Va	Virginia E&P	50.7%
6.	9.21	RI	Blackstone Valley Elec.	0.5%	91.	4.27	Ga	Georgia Power	53.9%
7. 8.	8.87 8.78	; Ct	United Illum. Hawaiian Electric	0.6% 1.0%	92.	4.23	Az	Salt River Project	54.3%
9.	8.51	: Ma	W. Massachusetts Elec.	1.1%	93. 94.	4.23	: Co : Tx	UtiliCorp United	54.4%
10.	8.49	N	Jersey Central P&L	1.6%	95.	4.17	In.	Texas Utilies Elec. Indianapolis P&L	57.3%
11.	8.46	Ma	Boston Edison	1.8%	96.	4.16	In	Northern Indiana P.S.	59.4%
12. 13.	8.30	N	Atlantic City Electric	1.9%	97.	4.16	. sc	South Carolina E&G	60.0%
14.	8.21 8.21	. Ca Me	Los Angeles Dept W&P		98.	4.16	- In	Indiana/Mich. Pwr.	60.8%
15.	7.80	N	Central Maine Power Public Service E&G	3.1% 4.2%	99. 100.	4.16 4.15	: Mo	Union Electric	61.5%
16.	7.64	- a	Connecticut L&P	4.7%	101.	4.14	NC	Memphis agency Duke Power Co.	63.8%
17.	7.63	: RI	Narragansett Elec.	4.8%	102.	4.09	Mo	St. Joseph L&P	63.9%
18.	7.51	y Pa	Peco Energy	3 6.8%	103.	4.05	L	New Orleans P.S.	64.0%
19. 20.	7.42 7.12	Me NY		6.9%	104.	4.04	وي ع	Ft. Collins L&P	64.0%
21.	6.64	CA	Orange/Rockland Utils Sacramento MUD	≟ 7.0% € 7.5%	105. 106.	3.97 3.96	i Ga	Savannah E&P	64.1%
22.	6.51	C	S. Calif. Edison	10.2%	107.	3.93	-NM	Kansas City P&L Southwestern PS	64.6%
23.	6.41	· Vt	Central Vermont P.S.	10.3%	108.	3.93	DC	Potomac Electric	64.6%
24.	6.38	- Az		10.7%	109.	3.90	- La	C. Louisiana Elec.	64.9%
25. 26.	6.32 6.20	Oh Ca	Cleveland Elec. Illum.	11.6%	110.	3.89	Wi	Wisconsin Elec. Power	. 66.0%
27.	6.17	0	San Diego G&E Pacific G&E	14.5%	111. 112	3.88 3.88	Co	Colorado Spr. Util. Midwest Pwr Sys	: 66.2% ! 66.5%
28.	6.15	Ma	Massachusetts Elec.	15.0%	113.	3.87	O	PacifiCorp	67.1%
29.	6.10	n	Commonwealth Edison		114.	3.87	Or	Portland GE	67.6%
30. 31.	5.85	Oh		19.2%	115.	3.85	П	C. Illinois Light	67.9%
31. 32.	5.84 5.71	Pa. Ak	Duquesne Light Golden Valley Elec.	19.6% 19.6%	116.	3.84 3.83	SC.	Duke Power Co. Kansas City BPU	69.4%
33.	5.58	Md	Delmarva P&L	19.6%	118.	3.82	wv	Appalachian Power	70.1%
34.	5.53	Ms.	Mississippi P&L	20.0%	119.	3.81	Mo	City Utilities	70.1%
35.	5.50	Mi	Detroit Edison	21.8%	120.	3.80	AI.	Alabama Power	72.7%
36. 37.	5.45 5.43	- Vt	Arkansas P&L Green Mountain Power	22.5% 222.6%	121. 122.	3.80 3.76	Ne	Lincoln Elec. System	72.7%
38.	5.40	Pa	Pennsylvania P&L	23.8%	123.	3.76	Ne Al	Decatur Utilities Grand Island Elec.	72.9%
39.	5.38	Mi	Consumers Power	25.4%	124.	3.70	Wa	PUD No. 1 Snohomish	73.0%
40.	5.35	, NV		25.8%	125.	3.68	Wa	Washington Water Pwr	
41. 42.	5.31 5.29	NM		25.8% 26.4%	126.	3.63	Mn	Minnesota P&L	74.0%
43.	5.18	, Az Gu		26.4%	127. 128.	3.62 3.62	Ut	PacifiCorp Iowa-Illinois G&E	74.8%
44.	5.07	NY	Niagara Mohawk Pwr.	27.9%	129.	3.62	Wi	Wisconsin P&L	75.5%
45.	5.06	NY	Central Hudson G&E	28.0%	130.	3.61	, In	S. Indiana G&E	75.7%
46.	5.05	NC	Fayetteville PW	28.1%	131.	3.59	La	Louisiana P&L	77.7%
47. 48.	5.04 5.02	NC Md	Carolina P&L Baltimore Gas & Elec.	29.5% 31.1%	132. 133.	3.58 3.55	. Wy	"Cheyenne L, F&P" Louisville G&E	77.7%
49.	5.00	F	Florida Power	31.5%	134.	3.55	Mt	PacifiCorp	78.1%
50.	4.98	Tn		31.5%	135.	3.54	In in	PSI Energy	79.3%
51. 52.	4.94	WV		231.6%	136.	3.53	Ms	Mississippi Pwr	79.8%
52. 53.	4.92	K	Kansas City P&L Florida P&L	32.1%	137. 138.	3.50 3.48	Ok	Interstate Power PS Oklahoma	80.1%
54.	4.89	Al	Huntsville agency	.32.3%:	139.	3.48	Va		81.4%
55.	4.88	Oh	Columbus S. Power	32.7%	140.	3.43	TX	Gulf States Utilities	82.2%
56.	4.87	In		33.4%	141.	3.41	Ar.		
57. 58.	4.86 4.85	ND.		34.1%	142. 143.	3.41 3.39	Ky		82.9%
59.	4.85	SC		34.5%	144.	3.38	Tx		84.4%
60.	4.85	Tn	Knoxville Agency	34.8%	145.	3.37	į Wy	PacifiCorp	85.1%
61.	4.80	Wa		35.3%	146.	3.37	L Wa		85.3%
62. 63.	4.79	r Ga		t 35.4%?	147.	3.36	Mo.		85.4%
63. 64.	4.77	L.No.		36.4% 36.9%	148. 149.	3.36 3.28	Ne Ne		85.7%
65.	4.70	Pa.		37.9%	150.	3.24	NM		85.9%
66.	4.69	NC	Virginia E&P	38.1%:	151.	3.20	, Wi	Wisconsin PS	86.3%
67.	4.66	Mi		38.2%	152	3.19	Md		86.9%
68. <del>69</del> .	4.64 4.61	Md ND		38.2%;	153. 154.	3.18 3.17	E Mt	Montana Power Washington Water Pwi	-87.3% -2 87.4%
70.	4.59	Ix		38.4%	155.	3.05	SC		88.1%
71.	4.59	L	Gulf States Utilities	39.4%	156.	3.03	Ok	Oklahoma G&E	88.8%
72.	4.58	Tn		39.8%	157.	2.97	Oh		91.5%
73. 74.	4.57	) Co		40.5%	158.	2.97	Ok		1 91.5% 91.6%
75.	4.57 4.56	Wi Oh		40.8%	159. 160.	2.96 2.94	Wa. Ky	Kentucky Power Co.	92.0%
76.	4.55	Mi	Lansing Bd. W&L	41.6%	161.	2.91	- Wa	Tacoma DPU	92.4%
77.	4.54	SD-	Black Hills Corp.	£ 41.6% ·	162.	2.68	Id	PacifiCorp	92.6%
78.	4.53	FI	Tampa Elec.	42.0%	163.	2.68	Ку	Green River Electric Bonneville Power Adm	93.1% 93.5%
79. 80.	4.49 4.49	SD Tx	Northwestern P.S. San Antonio PS Bd.	: 42.0%. : 42.4%	164. 165.	2.66 2.57	Or	Bonneville Power Adm Bonneville Power Adm	in93.8%
81.	4.47	Tx	Houston L&P	45.8%	166.	2.56	- Id	Idaho Power	94.4%
82_	4.43	Mn	Otter Tail Power	45.9%	167.	2.55	Wa	Bonneville Power Adm	in96.2%
83.	4.43	П	C. Illinois PS	46.2%	168.	2.06	NY	NY State Power Auth.	96.8%
84. 85.	4.41	∵ Ky WV		1 46.3% 46.9%	169.	1.74	: Ky	Elec. Energy Inc. Ohio Valley Flectric	97.8% 100.0%
03.	4.41	-	Monongahela Power	. 46.9%	170.	1.67	_ Oh	Ohio Valley Electric	,
There									ere These

These prices represent what electric utilities charged industrial customers in March 1995, based on dividing total revenue by total lowh sold to these customers. These prices may not reflect what individual customers were charged. Prices include demand, power, and fuel adjustment charges. Where possible, special rate programs for large customers have been eleminated to more closely represent actual per livih costs to most customers. Some utilities make arbitrary one-month adjustments in revenue talking that do not correspond to what customers were billed. The cumulative livih percentile talks what percent of the surveyed utilities' total livih was sold by the individual utility and those above it ranking as more costly. Source: DOE form EIA-826 and ELIW survey.

# **SECTION 4**

# SYSTEM SIZING PROCEDURES AND RESULTS

#### 4.1 ICE HARVESTING SYSTEMS

Appendix B contains manufacturer's literature for a typical ice harvesting type of system. Five alternative systems were evaluated, utilizing various combinations of run times vs. off times, and in addition varying the amount of time the systems ran making ice to the amount of time they ran as conventional chillers. The five systems analyzed are summarized in the following table.

ECO#	HOURS MAKING ICE	HOURS AS CHILLER	HOURS "OFF"
IH-1	8	16	0
IH-2	8	10	6
IH-3	12	12	0
IH-4	12	6	6
IH-5	8	13	3

As indicated in a previous section, the ice harvesting system has the ability to continue to produce chilled water during the hours it is in the ice-making mode, due to the fact that the generated ice is de-coupled from the ice-making apparatus. It is therefore available as a separate chilling source. Therefore, the columns labeled as "hours making ice" should not be interpreted as though chilled water cannot be produced during those hours. It simply means that the mechanical refrigeration system will be making ice during those periods.

Each of the indicated ECO's is discussed in the following sections.

# 4.1.1 ECO IH-1

In this analysis, the system was allowed to build ice during the eight hours of 1:00 a.m. through 9 a.m. inclusive. During the remaining sixteen hours of the day, the plant was allowed to operate as a normal chiller. Applying those parameters to the June to September load profile for Area 600, it was found that an ice storage capacity of 2200 ton-hours coupled with a nominal chiller tonnage of 630 tons (485 tons when making ice) would meet all load conditions and would never totally deplete the tank ice capacity. See Appendix C for the load and demand profile printouts. This results in a relatively low first cost compared to the other alternatives. However, since the refrigeration plant is never "off," demand charges are not avoided, which is the major thrust of the project.

# 4.1.2 ECO IH-2

In an effort to address the demand changes incurred under ECO IH-1, ECO IH-2 turned the chiller "off" during the mid-afternoon period from noon through 6:00 p.m. All other operational hours remained unchanged from ECO IH-1.

The results of this approach was to drive up significantly the required ice-making capacity of the plant, since stored ice would be all that would be available to carry load during the chiller "off" period. The nominal chiller capacity rose to 1,150 tons (885 tons of ice-making capacity), and ice storage volume of 5,000 ton-hours. Load and demand profiles are contained in Appendix C.

# 4.1.3 ECO IH-3

This ECO was another variation of ECO IH-1. It was suggested that it might be possible that, in exchange for a longer ice-build time, the size of the chiller needed to supplement the stored ice during the peak afternoon hours might be reduced to the point that the incurred demand charges associated with the chiller might be more economically bearable.

As a result, the ice-build time was expanded to 12 hours, running from 9:00 p.m. through 9:00 a.m. inclusive. From 9:00 a.m. until 9:00 p.m., the system was used to generate chilled water. The resulting load and demand profiles are contained in Appendix C. While extension of the ice build time did result in a smaller chiller requirement, the reduction in size from ECO IH-1 was very slight, from 630 tons to 625 (or from 485 tons of ice-making capacity to 480). As might be expected, the required ice storage capacity increased slightly from 2,200 ton-hours under ECO IH-1 to 2,400 ton-hours under ECO IH-3.

# 4.1.4 ECO IH-4

This ECO was a modification of ECO IH-3, using the same ice-making hours, but again turning the chiller plant "off" from noon through 6:00 p.m., to avoid demand charges, as was done under ECO IH-2.

The results of this approach were encouraging. Requiring the stored ice to carry the total load during the six afternoon hours drove the ice-making tonnage up from 480 to 750 tons, but the allowance of 12 hours for making ice meant that the 750 tons of capacity was considerably less than the 885 tons that had been required under ECO IH-2. At the same time, the storage capacity required under this ECO was found to be 5,000 ton-hours, which is the same as that required under ECO IH-2.

Again, cooling load and demand profiles for this ECO are contained in Appendix C.

#### 4.1.5 ECO IH-5

A close analysis of the electrical demand profile curve obtained from the electric utility company, referred to in Section 3, indicates that there may be a window of demand establishment as narrow as three hours (from 1:00 p.m. to 4:00 p.m.) during which time an imposition of any additional large refrigeration plant loads on a design day would definitely result in establishment of a new demand peak. Conversely, it appears that the demand loads outside of this hour range fall off steeply enough that powering of the refrigeration plant would not result in establishment of a new demand peak.

Under this hypothesis, an analysis similar to ECO IH-2 was developed, but one in which the chiller was off only from 1:00 p.m. to 4:00 p.m. It was used to build ice between 1:00 a.m. and 9:00 a.m., and would be used as a chiller during the remainder of the day. The results of this approach appeared to be quite promising. The required chiller capacity was reduced to 820 tons from the 1,150 tons needed under ECO IH-2, and the thermal storage capacity was reduced from 5,000 ton-hours to 2,600 ton-hours.

Of course, the value of these numbers is dependant upon the validity of the hypothesis stated above. This approach results is a "fine-tuned" solution to a narrow period of peak demand. The resulting cooling and peak demand load profiles are in Appendix C.

# 4.2 ICE TANK SYSTEMS

Appendix B contains manufacturer's literature for a typical ice tank type of system. As with the ice harvesting systems, a total of five alternative systems were evaluated with different mixes of chilling, ice-building, and off hours over a 24-hour period. The following table summarizes these combinations:

	HOURS	HOURS AS	
ECO#	MAKING ICE	CHILLER	HOURS "OFF"
IT-1	8	16	0
IT-2	11	13	0
IT-3	8	10	6
IT-4	11	7	6
IT-5	11	10	3

Each of the indicated ECO's is discussed in the following sections.

# 4.2.1 ECO IT-1

In this first analysis, the ice tank was charged during the period from 1:00 a.m. through 9:00 a.m., and was drawn down (supplemented by the refrigeration equipment producing chilled water) during the other hours of the day. There was no period when all equipment was "off." A supplemental chiller was used at night to provide cooling to the Barracks buildings while the main system was building ice.

This scenario resulted in the need for an ice-making capacity of 375 tons (approximately 500 chiller tons) coupled to an ice-tank with a thermal storage capacity of 3,300 ton-hours. In addition, a night chiller with a 400 ton cooling capacity would also be required. While this results in a relatively small total chiller capacity, it is noted that in this option, as in ECO IH-1, there is never an "off" period for the cooling plant, so demand charges are never truly avoided.

Appendix C contains the ice plant loading and demand profiles for the cooling months. It should be noted that this printout does not include the load/demand met by the separate night chiller, since this is independent of the thermal storage plant. Energy usage of the night chiller system is accounted for in energy printouts which will be presented later. This is true for all of the ice tank system alternatives analyzed.

# 4.2.2 ECO IT-2

ECO IT-2 was developed as a means of reducing the size of the chiller which would need to run during the afternoon hours by having more supplemental ice available by lengthening the ice build time. Therefore, the ice build time period was extended to run from 11:00 p.m. until 10:00 a.m., a total of 11 hours, with the chiller generating chilled water the rest of the time.

As with ECO IH-3, where the same approach was tried, there was some benefit in demand reduction, but not a large one. The chiller tonnage dropped from 500 tons to 450 tons compared to ECO IT-1, which is an ice-making tonnage reduction from 375 tons to 345 tons. However, the ice tank thermal storage volume rose from 3,300 ton-hours to 4,000 ton-hours. Also, the size of the night chiller required rose from 400 tons to 450 tons. See Appendix C for the summer load and demand profiles.

# 4.2.3 ECO IT-3

This scenario uses the hours from 1:00 a.m. to 9:00 a.m. for ice building and turns all mechanical equipment (except chilled water pumps) off from 12 noon until 6:00 p.m. to avoid adding to peak demands established during that period. During other hours, the refrigeration equipment runs as a conventional chiller.

The requirements for stored ice to serve as the sole means of carrying load over a six-hour period drove up both the size of the thermal storage tank (to 6000 ton-hours) and the ice-making capacity of the refrigeration plant, to 625 tons (approx. 810 tons of normal chilling

capacity). Since the ice-build time was reduced to the same 8 hour period used in ECO IT-1, however, the night chiller's capacity returned to 400 tons, as was the case in ECO IT-1. Appendix C contains the summer load and demand profiles for this case.

# 4.2.4 ECO IT-4

This alternative assumed that ice will be built over an 11 hour period from 11:00 p.m. until 10:00 a.m., that all systems except chilled water pumps will be off during the period from 12 noon until 6:00 p.m. to avoid demand charges, and that the refrigeration plant will operate as a chiller during all other periods.

The effect of extending the ice build time by 3 hours compared to ECO IT-2 is to reduce the required size of the ice-making capacity of the refrigeration plant since it has a longer time available over which to build the required ice. As a result, the capacity requirement dropped to 490 tons (635 tons chilling capacity) compared to the 625 tons (810 tons chilling) of ice-making capacity required in ECO IT-3. The size of the storage tank remained at 6,000 ton-hours, however. Also, the size of the night chiller required to serve the Barracks buildings increased to 450 tons. Load and demand profiles are presented in Appendix C.

#### 4.2.5 ECO IT-5

As with ECO IH-5, this ECO narrowed the peak demand window to three hours from 1:00 p.m. until 4:00 p.m. Also as with ECO IH-5, the result was a significant improvement over use of a six hour "off" period for the refrigeration plant. The required ice-making tonnage dropped to 400 tons (520 tons chilling capacity) and required total thermal storage was reduced to 4,500 ton-hours. The same caution applies here that was stated in the ECO IH-5 discussion. The results are only valid if total Fort demand is low enough prior to 1:00 p.m. and after 4:00 p.m. See Appendix C for cooling load and demand profiles for this ECO.

# 4.3 BASE CASE

As stated earlier, a conventional mid-range efficiency centrifugal chiller was used as the base case against which the various ECO's would be compared. The peak load calculated for Area 600 resulted in selection of a chiller with a nominal capacity of 900 tons. Manufacturer's literature for such a typical chiller is included in Appendix B.

# 4.4 SUMMARY OF RESULTS

The following table summarizes the results presented in the preceding paragraphs, upon which energy calculations were based:

ECO#	REQUIRED ICE- MAKING TONS	EQUIVALENT CHILLER TONS	REQUIRED NIGHT CHILLER CAPACITY	REQUIRED TON-HOURS THERMAL STORAGE
IH-1	485	630		2,200
IH-2	885	1,150		5,000
IH-3	480	625		2,400
IH-4	750	975		5,000
IH-5	630	820 .		2,600
IT-1	375	490	400	3,300
IT-2	345	450	450	4,000
IT-3	625	815	400	6,000
IT-4	490	635	450	6,000
IT-5	400	520	450	4,500
BASE		900		

# **SECTION 5**

# ENERGY AND DEMAND CALCULATIONS

# 5.1 BASIS OF CALCULATIONS

Individual printouts of each ECO's energy usage (KWH) and component month-by-month peak electrical demand (KW) are contained in Appendix D. Also included therein is the same data for the Base Case of the centrifugal chiller.

The tabulations which follow use this data and data taken from the typical hour-by-hour demand curve for the Fort which was obtained from the utility company to estimate what the electric utility cost difference would be between a given ECO and the Base Case. The electric utility costs incurred are based upon the sum of the energy (KWH) costs and the demand (KW) costs. Each will be explained in turn.

# a) Energy (KWH) Costs

Energy costs are simple to determine. The various components in the system each consume energy on a continuing basis. This continuous usage is tallied over a given monthly billing period and the resulting KWH total is then multiplied by the cost per KWH to obtain the energy cost. This procedure is independent of when during the day the energy was used. All usage is figured into the energy cost billed.

# b) Demand (KW) Costs

The logic in calculation of demand costs is different. The factor which will determine a demand charge which appears on a monthly statement is the highest KW demand established over the preceding 12 months. This demand is typically established during mid-afternoons of summer months, when air conditioning systems are under peak loads. Therefore, it is very beneficial to minimize or eliminate KW loads during this period.

Therefore, in order to estimate the effect of a given system alternative on total billing demand it was necessary to estimate what the Fort's hourly base demand is during a peak month (taken as July) and then add to that the demands which would be established by that system's cooling plant. The sum of these at each hour is the total peak demand at that hour. The hour with the greatest demand is then taken as establishing the demand which will be billed for the next 12 months.

Using the historical demand curve previously referenced, the following figures were used to estimate base demand for the Fort during a peak day in July:

DEMAND (KW)
26,600
28,000
29,100
30,000
29,000
28,400
27,700

# 5.2 BASE CASE PROCEDURES AND RESULTS

Hourly chiller KW demand loads were calculated using a selected machine capacity of 900 tons and applying a part-load efficiency curve to the hourly loads calculated to occur during the design July afternoon period. The chiller was selected to have a peak efficiency of .73 KW per ton, which is a mid-range efficiency selection. Such a selection represents a good value between a high-efficiency chiller and one with a low first cost.

All other system components (pumps, cooling towers), being essentially non-modulating in nature, were taken as establishing their design demand KW throughout the design day afternoon. Energy consumption data were taken directly from the TRACE program output. The following table summarizes this data.

# I. DEMAND COMPONENT

Hour	1100	1200	1300	1400	1500	1600	1700
Base Demand	26,600	28,000	29,100	30,000	29,000	28,400	27,700
Centr. Chiller	483	567	541	564	597	659	649
Cooling Tower	72	72	72	72	72	72	72
Cond. Water Pur	mps 15	15	15	15	15	15	15
Ch. Water Pump	s 28	28	28	28	28	28	28
_							
	27,198	28,682	29,756	30,679	29,712	29,174	28,464

Demand in excess of peak:

679 KWD

Demand cost over 12 months:

\$50,395 (at \$6.185 per KWD)

# II. ENERGY COMPONENT

Month	Jun	Jul	Aug	Sept	Total
KWHR usage for: Centr. Chiller	358,950	427,172	365,049	284,634	1,435,805

Annual KWHR Cost:

\$35,895 (at \$.025 per KWHR)

Total Annual Utility Cost: \$86,290

# 5.3 ICE HARVESTER SYSTEM ECO'S

The following five sub-sections present the results of demand and energy usage calculations for each ECO, displays the savings in demand and usage between that ECO and the base case, and applies the appropriate KWD and KWHR unit costs to those savings. A resulting annual utility cost savings is shown at the bottom of each tabulation.

It may be noted that one piece of equipment that is listed in the Appendix D energy and demand tabulations is the "Water Circulating Pump-Constant Volume." This pump only runs during the ice-making mode. Therefore, it is off during the hours from 11:00 a.m. to 5:00 p.m.

# 5.3.1 ECO IH-1

Comments: This system, while producing some demand and energy savings, does not look promising. The total annual savings of \$9,485 is rather insignificant.

# I. DEMAND COMPONENT

Hour 1100	1200	1300	1400	1500	1600	1700
Base Demand 26,600	28,000	29,100	30,000	29,000	28,400	27,700
630 Ton Chiller 452	461	465	466	467	465	460
Cooling Tower Fans 50	50	50	50	50	50	5050
Ch. Water Pump 28	28	28	28	28	28	28
Cond. Water Pumps 11	11	11	11	11	11	11
28,141	28,550	29,654	30,555	29,556	28,954	28,249

Peak Demand Reduction Compared to Base Case: 124
Annual demand savings at \$6.185 per KWD: \$9,203

# II. ENERGY COMPONENT

Month	Jun	Jul	Aug	Sept	Annual
KWHR usage for:					
630 Ton Chiller Base case	350,261 358,950	438,155 427,172	361,489 365,049	274,636 284,634	1,424,541 1,435,805
Savings Compared to Base Case	8,689	-10,983	3,560	9,998	11,264
Annual energy savings @		\$282			

TOTAL ANNUAL UTILITY COST SAVINGS FOR THIS ECO: \$9,485

# 5.3.2 ECO IH-2

Comments: Significant improvement over ECO IH-1, due to the peak KWD reduction resulting from the chiller, cooling tower, and condenser water pumps being turned off at the peak hour. There is, however, an increase in energy usage due to the size of the ice making chillers and the fact that it takes more energy to make ice than to chill water.

# I. DEMAND COMPONENT

Hour 1	100	1200	1300	1400	1500	1600	1700
Base demand 26,	600	28,000	29,100	30,000	29,000	28,400	27,700
1,150 Ton Chiller	455	. 0	0	0	0	0	0
Cooling Tower Fans	92	0	0	0	0	0	0
Ch. Water Pump	28	28	28	28	28	28	28
Cond. Water Pump	20	0	0	. 0	0	0	0
27,	195	28,028	29,128	30,028	29,028	28,428	27,728

Peak Demand reduction Compared to Base Case: 651
Annual Demand Savings at \$6.185 per KWD: \$48,317

# II. ENERGY COMPONENT

Month	Jun	Jul	Aug	Sept	Annual
KWHR usage for:					
1,150 Ton Chiller Base case	394,773 358,950	493,612 427,172	423,914 365,049	333,373 284,634	1,645,672 1,435,805
Savings Compared to Base Case	-35,823	-66,440	-58,865	-48,739	-209,867
Annual energy savings @	(\$5,247)				

TOTAL ANNUAL UTILITY COST SAVINGS FOR THIS ECO: \$43,071

# 5.3.3 ECO IH-3

Comment: This system results in less energy savings than ECO IH-1. More energy is consumed because four hours of operation were shifted to ice-making from water chilling. As noted in the previous paragraph, ice-making uses more energy than water chilling. At the same time, the shift in usage did not produce a meaningful increase in KWD reduction.

# I. DEMAND COMPONENT

Hour 1	100	1200	1300	1400	1500	1600	1700
Base Demand 26.	,600	28,000	29,100	30,000	29,000	28,400	27,700
625 Ton Chiller	449	457	461	462	463	462	462
Cooling Tower Fans	50	50	50	50	50	50	50
Ch. Water Pump	28	28	28	28	28	28	28
Cond. Water Pump	11	11	11	. 11	11	11	11
27	,138	28,546	29,650	30,551	29,552	28,951	28,251

Peak Demand Reduction Compared to Base Case: 128
Annual Demand Savings at \$6.185 per KWD: \$9,500

# II. ENERGY COMPONENT

Month	Jun	Jul	Aug	Sept	Annual
KWHR usage for:					
625 Ton Chiller	354,982	460,020	359,978	275,994	1,405,974
Base Case	358,950	427,172	365,049	284,634	1,435,805
Savings Compared	****				
to Base Case:	3,968	-32,848	5,071	8,640	-15,169
Annual Energy Savings	at \$.025 per KV	VHR:	(\$379)		
Annual utility cost saving			\$9,121		

# 5.3.4 ECO IH-4

Comments: The results of this system compared to ECO IH-2 are very similar to the results of ECO IH-3 compared to ECO IH-1. There is a very small reduction in energy savings which results from shifting four hours of water chilling to ice-building. This is again due to the relative energy inefficiency of ice building, as compared to water chilling. Demand reduction, on the other hand, did not change.

# I. DEMAND COMPONENT

Hour 110	0 1200	1300	1400	1500	1600	1700
Base Demand 26,60	0 28,000	29,100	30,000	29,000	28,400	27,700
975 Ton Chiller 45	4 0	0	0	0	0	0
Cooling Tower Fans 7	8 0	0	0	0	0	0
Ch. Water Pump 2	8 28	28	28	28	28	28
Cond. Water Pump 1	6 0	0	. 0	0	0	0
27,17	6 28,028	29,128	30,028	29,028	28,028	27,728

Peak Demand Reduction Compared to Base Case: 651
Annual Demand Savings at \$6.185 per KWD: \$48,317

# II. ENERGY COMPONENT

Month	Jun	Jul	Aug	Sept	Annual
KWHR usage for:					
975 Ton Chiller	398,148 358,950	505,719 427,172	426,572 365,049	322,145 284,634	1,652,584 1,435,805
Base Case		427,172		204,034	
Savings Compared to Base Case:	-39,198	-78,547	-61,523	-37,511	-216,779

Annual Energy Savings at \$.025 per KWHR: (\$5,419)

TOTAL ANNUAL UTILITY COST SAVINGS FOR THIS ECO: \$42,898

# 5.3.5 ECO IH-5

Comments: As might be expected, the narrowing of the demand "window" during which ice must be available to carry load from six hours to three hours results in the greatest energy savings. This is because less ice-making time at night is needed and, therefore, ice-making inefficiencies are minimized.

# I. DEMAND COMPONENT

Hour 1100	1200	1300	1400	1500	1600	1700
Base Demand 26,600	28,000	29,100	30,000	29,000	28,400	27,700
820 Ton Chiller 463	560	0	0	0	606	599
Cooling Tower Fans 66	66	0	0	0	66	66
Ch. Water Pump 28	3 28	28	28	28	28	28
Cond. Water Pump 14	14	0	. 0	0	14	14
27,17	28,668	29,128	30,028	29,028	29,114	28,407

Peak Demand Reduction Compared to Base Case: 651
Annual Demand Savings at \$6.185 per KWD: \$48,317

# II. ENERGY COMPONENT

Month	Jun	Jul	Aug	Sept	Annual			
KWHR usage for:								
820 Ton Chiller	358,977	453,487	379,911	297,877	1,490,252			
Base Case	358,950	427,172	365,049	284,634	1,435,805			
Savings Compared								
to Base Case:	-27	-26,315	-14,862	-13,243	-54,447			
Annual Energy Savings at \$.025 per KWHR:								
TOTAL ANNUAL UTILITY COST SAVINGS FOR THIS ECO:								

# 5.3.6 SUMMARY TABLE

ECO	Annual Utility Savings Compared to Base Case			
IH-1	\$	9,485		
IH-2	\$	43,071		
IH-3	\$	9,121		
IH-4	\$	42,898		
IH-5	\$	46,956		

# 5.4 ICE TANK SYSTEM ECO'S:

The following sub-sections are arranged in the same manner as those in Section 5.3. Inasmuch as the components associated with the night chiller system only run at night, none of them (the chiller, cooling tower, condenser water pump) are listed in the demand tabulations.

# 5.4.1 ECO IT-1

Comments: Savings achieved by this system are rather modest, due to the fact that no equipment is turned off during the peak demand period. Demand reduction, though, is better than that achieved by the similar Ice Harvester System IH-1. Annual savings achieved by this ECO amount of \$15,200.

# I. DEMAND COMPONENT

Hour	1100	1200	1300	1400	1500	1600	1700
Base demand 2	6,600	28,000	29,100	30,000	29,000	28,400	27,700
500 Ton Chiller	384	391	394	395	396	395	390
Cooling Tower Far	ns 41	41	41	41	41	41	41
Ch. Water Pump	28	28	28	28	28	28	28
Cond. Water Pump	14	14	14	. 14	14	14	14
	7,067	28,474	29,577	30,478	29,479	28,878	28173

Peak Demand Reduction Compared to Base Case: 201
Annual Demand Savings at \$6.185 per KWD: \$14,918

# II. ENERGY COMPONENT

Month	Jun	Jul	Aug	Sept	Annual		
KWHR usage for:							
500 Ton Chiller Base Case	350,261 358,950	438,155 427,172	361,489 365,049	274,636 284,634	1,424,541 1,435,805		
Savings Compared to Base Case:	8,689	-10,983	3,560	9,998	11,264		
Annual Energy Savings at \$.025 per KWHR:							
TOTAL ANNUAL UTILITY COST SAVINGS FOR THIS ECO: \$1							

# 5.4.2 ECO IT-2

Comments: This shows that shifting the schedule to make more hours available for ice production with the resultant downsizing of the afternoon chiller load does have a beneficial effect. Savings increased from the \$15,200 of ECO IT-1 to almost \$20,000. Significant peak demand costs, however, are still incurred.

# I. DEMAND COMPONENT

Hour 11	100	1200	1300	1400	1500	1600	1700
Base Demand 26,6	600	28,000	29,100	30,000	29,000	28,400	27,700
450 Ton Chiller	346	352	355	356	356	356	351
Cooling Tower Fans	37	37	37	37	37	37	37
Ch. Water Pump	28	28	28	28	28	28	28
Cond. Water Pump	14	14	14	. 14	14	14	14
27,0	025	28,431	29,534	30,435	29,435	28,835	28,130

Peak Demand Reduction Compared to Base Case: 244
Annual Demand Savings at \$6.185 per KWD: \$18,110

# II. ENERGY COMPONENT

Month	Jun	Jul	Aug	Sept	Annual		
KWHR usage for:							
450 Ton Chiller Base Case	328,168 358,950	426,614 427,172	350,686 365,049	256,216 284,634	1,361,684 1,435,805		
Savings Compared to Base Case:	30,782	558	14,363	28,418	74,121		
Annual Energy Savings at \$.025 per KWHR:							
TOTAL ANNUAL UTILITY COST SAVINGS FOR THIS ECO:							

# 5.4.3 ECO IT-3

Comments: This option clearly demonstrates the importance of eliminating all peak demands. In turning off the chilling plant during the projected peak demand hours, annual energy savings jumped from the \$15,200 figure of ECO IT-1 to almost \$49,000.

# I. DEMAND COMPONENT

Hour 1	100	1200	1300	1400	1500	1600	1700
Base Demand 26,	600	28,000	29,100	30,000	29,000	28,400	27,700
810 Ton Chiller	496	0	0	0	0	0	0
Cooling Tower Fans	66	0	0	0	0	0	0
Ch. Water Pump	28	28	28	28	28	28	28
Cond. Water Pump	20	0	0	0	0	0	0
27,	210	28,028	29,128	30,028	29,028	28,428	27728

Peak Demand Reduction Compared to Base Case: 651
Annual Demand Savings at \$6.185 per KWD: \$48,317

# II. ENERGY COMPONENT

Month	Jun	Jul	Aug	Sept	Annual
KWHR usage for:					
810 Ton Chiller	336,084	435,802	366,197	288,333	1,426,416
Base Case	358,950	427,172	365,049	284,634	1,435,805
Savings Compared					
to Base Case:	22,866	-8,630	-1,148	-3,699	9,389
Annual Energy Savings	at \$.025 per KV	VHR:		\$235	

TOTAL ANNUAL UTILITY COST SAVINGS FOR THIS ECO: \$48,552

### 5.4.4 ECO IT-4

Comments: This option of keeping the same amount of afternoon off hours while lengthening the amount of time during which ice could be made showed a very marginal improvement in savings over ECO IT-3. Annual savings increased by less than \$1,000, to roughly \$49,400.

### I. DEMAND COMPONENT

Hour 11	00	1200	1300	1400	1500	1600	1700
Base Demand 26,6	00	28,000	29,100	30,000	29,000	28,400	27,700
635 Ton Chiller 4	56	0	0	0	0	0	0
Cooling Tower Fans	51	0	0	0	0	0	0
Ch. Water Pump	28	28	28	28	28	28	28
Cond. Water Pump	17	0	0	0	0	0	0
27,1	52	28,028	29,128	30,028	29,028	28,428	27,728

Peak Demand Reduction Compared to Base Case: 651
Annual Demand Savings at \$6.185 per KWD: \$48,317

### **II. ENERGY COMPONENT**

Month	Jun	Jul	Aug	Sept	Annual
KWHR usage for:					
635 Ton Chiller Base Case	328,844 358,950	430,629 427,172	358,020 365,049	276,736 284,634	1,394,229 1,435,805
Savings Compared	<u></u>				
to Base Case:	30,106	-3,457	7,029	7,898	41,576
Annual Energy Savings a		\$1,039			

TOTAL ANNUAL UTILITY COST SAVINGS FOR THIS ECO: \$49,357

### 5.4.5 ECO IT-5

Comments: As might be expected, the "best case" approach of being able to shut down all systems only during three hours in the afternoon allowed the best annual savings to be achieved, approaching \$50,000.

### I. DEMAND COMPONENT

Hour 1100	1200	1300	1400	1500	1600	1700
Base Demand 26,600	28,000	29,100	30,000	29,000	28,400	27,700
520 Ton Chiller 399	407	0	0	0	411	406
Cooling Tower Fans 42	42	0	0	0	42	42
Ch. Water Pump 28	28	28	28	28	28	28
Cond. Water Pump 16	16	0	0	0	16	16
27,085	28,493	29,128	30,028	29,028	28,897	28,192

Peak Demand Reduction Compared to Base Case: 651
Annual Demand Savings at \$6.185 per KWD: \$48,317

### II. ENERGY COMPONENT

Month	Jun	Jul	Aug	Sept	Annual	
KWHR usage for:						
520 Ton Chiller Base Case	330,432 358,950	430,572 427,172	355,477 365,049	269,063 284,634	1,385,544 1,435,805	
Savings Compared to Base Case:	28,518	-3,400	9,572	15,571	50,261	
Annual Energy Savings at \$.025 per KWHR:						
TOTAL ANNUAL UTILITY COST SAVINGS FOR THIS ECO:						

#### **SECTION 6**

### COST ESTIMATES, LCC PRINTOUTS, AND RESULTS

Appendix E contains the conceptual cost estimates for each of the ECO's and the Base Case. Equipment sizes were determined from the cooling load calculations and costs were obtained from sales engineers representing manufacturers. Installation costs were taken from the 1995 Means Estimating Guides, and allowances were made for associated materials such as piping and insulation. In addition, costs were factored in for associated work and burdens such as controls, balancing, and project manuals and start-up. Markup rates of 10% for overhead and profit and 15% for contingencies were added to estimate totals.

The LCCID program approaches this type of project by comparing ECO costs to ECO savings. As a result, since this is in effect a replacement project, data was entered for each of the ECO's by entering the difference in construction costs between the ECO and the Base Case as the ECO cost, and the utility cost difference between the ECO and the Base Case as the ECO savings. An economic life of 20 years was used for the analysis.

Utility costs entered were taken directly from the ICO utility cost summaries tabulated in Section 5. No meaningful non-energy recurring or non-recurring costs are anticipated that would be distinguishable between any of the ECO's and the Base Case.

The resulting LCC Analysis Summaries for the 10 ECO's are presented on the following pages, and are summarized below:

ECO	Total Investment*	Total Discounted Savings	Simple Payback <u>Period (Yrs)</u>	SIR	Adjusted <u>I.R.R.</u>
IH-1	\$ 948,394	\$ 141,412	99.99	.15	-6.35
IH-2	2,231,477	635,640	51.81	.28	-3.27
IH-3	938,656	135,338	102.91	.14	-6.51
IH-4	1,174,666	632,896	27.38	.54	14
IH-5	1,067,969	697,342	22.74	.65	.83
IT-1	536,849	226,452	35.32	.42	-1.35
IT-2	648,009	298,903	32.46	.46	91
IT-3	1,048,431	722,684	21.59	.69	1.10
IT-4	968,714	735,463	19.63	.76	1.59
IT-5	759,010	738,911	15.31	.97	2.86

<sup>\*</sup>Compared to Base Case

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_IFE CYCLE COST ANALYSIS SUMMARY STUDY: FLWSTOR ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) LCCID FY95 (92)
INSTALLATION & LOCATION: FORT LEONARD WREGION NOS. 7 CENSUS: 2
PROJECT NO. & TITLE: 930073-0017 COLD THERMAL STORAGE ANALYSIS
FISCAL YEAR 1996 DISCRETE PORTION NAME: ECO IH-1
ANALYSIS DATE: 08-21-95 ECONOMIC LIFE 20 YEARS PREPARED BY: T. J. GRANT
1. INVESTMENT
A. CONSTRUCTION COST $ 769817.
D. TOTAL COST (1A+1B+1C) $ 948394.
E. SALVAGE VALUE OF EXISTING EQUIPMENT $
F. PUBLIC UTILITY COMPANY REBATE $
                                                 s 948394.
G. TOTAL INVESTMENT (1D - 1E - 1F)
2. ENERGY SAVINGS (+) / COST (-)
DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1994
        UNIT COST SAVINGS ANNUAL $ DISCOUNT DISCOUNTED
    FUEL $/ MWH(1) MWH/YR(2) SAVINGS(3) FACTOR(4) SAVINGS(5)
                        11. $ 282. 15.88 $ 4472.
0. $ 0. 19.16 $ 0.
0. $ 0. 21.43 $ 0.
0. $ 0. 18.30 $ 0.
0. $ 0. 18.30 $ 0.
0. $ 0. 18.20 $ 0.
0. $ 7203. 14.88 $ 136941.
    A. ELECT $ 25,00
    B. DIST $ .00
    C. RESID $ .00
    D. NAT G $ .00
E. COAL $ .00
F. PPG $ .00
M. DEMAND SAVINGS
                            11. $
                                                                 $ 141412.
                                            9485.
    N. TOTAL
3. NON ENERGY SAVINGS(+) / COST(-)
   A. ANNUAL RECURRING (+/-)
                                                                          0...
       (1) DISCOUNT FACTOR (TABLE A)
                                                        14.88
        (2) DISCOUNTED SAVING/COST (3A X 3A1)
                                                                          0...
   B. NON RECURRING SAVINGS(+) / COSTS(-)
                             SAVINGS(+) YR DISCNT DISCOUNTED

COST(-) OC FACTR SAVINGS(+)/

(1) (2) (3) COST(-)(4)
                               COST(-) OC FACTR
(1) (2) (3)
                                                           SAVINGS(+)/
                ITEM
                             $ 0.
                                                                    0.
    d. TOTAL
   C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-)(3A2+3Bd4)$
4. FIRST YEAR DOLLAR SAVINGS 2N3+3A+(3Bd1/(YRS ECONOMIC LIFE))$
                                                                    99.99 YEARS
5. SIMPLE PAYBACK PERIOD (19/4)
6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C)
                                                              $ 141412.
7. SAVINGS TO INVESTMENT RATIO (SIR)=(6 / 18)=
                                                                     2 1 E
    (IF < 1 PROJECT DOES NOT QUALIFY)
                                                                    -6.35 %
```

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR);

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LIFE CYCLE COST ANALYSIS SUMMARY STUDY: FLWSTOR ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) LCCID FY95 (92) INSTALLATION & LOCATION: FORT LEGNARD WREGION NOS. 7 CENSUS: 2
PROJECT NO. & TITLE: 930073-0017 COLD THERMAL STORAGE ANALYSIS
FISCAL YEAR 1996 DISCRETE PORTION NAME: ECO IH-2
ANALYSIS DATE: 08-21-95 ECONOMIC LIFE 20 YEARS PREPARED BY: T. J. GRANT
1. INVESTMENT
A. CONSTRUCTION COST $ 1920564.

B. SIGH $ 148698.

C. DESIGN COST $ 162215.
D. TOTAL COST (1A+1B+1C) $ 2231477.
$ 2231477.
2. ENERGY SAVINGS (+) / COST (-)
DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1994
           UNIT COST SAVINGS ANNUAL $ DISCOUNT DISCOUNTED
                       MWH/YR(2) SAVINGS(3) FACTOR(4) SAVINGS(5)
          $/ MWH(1)
    FLIEL
   3. NON ENERGY SAVINGS(+) / COST(-)
                                                                  0.
   A. ANNUAL RECURRING (+/-)
      (1) DISCOUNT FACTOR (TABLE A)
                                                  14.88
      (2) DISCOUNTED SAVING/COST (3A X 3A1)
   B. NON RECURRING SAVINGS(+) / COSTS(-)
                          SAVINGS(+) YR DISCNT DISCOUNTED

COST(-) OC FACTR SAVINGS(+)/

(1) (2) (3) COST(-)(4)
                                                     SAVINGS(+)/
              ITEM
                          $ O.
   d. TOTAL
   C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-)(3A2+3Bd4)$ 0.
4. FIRST YEAR DOLLAR SAVINGS 2N3+3A+(3Bd1/(YRS ECONOMIC LIFE))$ 43070.
                                                            51.81 YEARS
5. SIMPLE PAYBACK PERIOD (1G/4)
                                                         $ 635640.
6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C)
7. SAVINGS TO INVESTMENT RATIO (SIR)=(6 / 1G)=
   (IF < 1 PROJECT DOES NOT GUALIFY)
                                            A. ADJUSTED INTERNAL RATE OF RETURN (AIRR):
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LIFE CYCLE COST ANALYSIS SUMMARY

ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

INSTALLATION & LOCATION: FORT LEONARD WREGION NOS. 7 CENSUS: 2 FROJECT NO. & TITLE: 930073-0017 COLD THERMAL STORAGE ANALYSIS FISCAL YEAR 1996 DISCRETE PORTION NAME: ECO IH-3 ANALYSIS DATE: 08-21-95 ECONOMIC LIFE 20 YEARS PREPARED BY: T. J. GRANT 1. INVESTMENT A. CONSTRUCTION COST \$ 761083. B. SIOH \$ 84926. C. DESIGN COST \$ 92647. D. TOTAL COST (1A+1B+1C) \$ 938656. E. SALVAGE VALUE OF EXISTING EQUIPMENT \$
F. PUBLIC UTILITY COMPANY REBATE \$
G. TOTAL INVESTMENT (1D - 1E - 1F) o. o. s 938656. 2. EMERGY SAVINGS (+) / COST (-) DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1994 UNIT COST SAVINGS ANNUAL \$ DISCOUNT DISCOUNTED FUEL \$/ MWH(1) MWH/YR(2) SAVINGS(3) FACTOR(4) SAVINGS(5) -15. \$ -379. 15.88 \$
0. \$ 0. 19.16 \$
0. \$ 0. 21.43 \$
0. \$ 0. 18.30 \$
0. \$ 0. 16.62 \$
0. \$ 0. 18.20 \$
\$ 9500. 14.88 \$ -6022. A. ELECT \$ 25.00 () . B. DIST \$ .00 21,43 \$ () <sub>x</sub> C. RESID \$ .00 18.30 \$ 0. 16.62 \$ 0. 18.20 \$ 0. 14.88 \$ 141360. D. NAT G \$ .00 E. COAL \$ .00 F. PPG \$ .00 M. DEMAND SAVINGS -15. \* **\$** 135338. 9121. N. TOTAL 3. NON ENERGY SAVINGS(+) / COST(-) A. ANNUAL RECURRING (+/-) <>> ₁ (1) DISCOUNT FACTOR (TABLE A) 14.88 () ... (2) DISCOUNTED SAVING/COST (3A X 3A1) B. NON RECURRING SAVINGS(+) / COSTS(-) SAVINGS(+) YR DISCNT DISCOUNTED COST(-) OC FACTR SAVINGS(+)/ SAVINGS(+)/ ITEM (1) (2) (3)COST(-)(4) s O. 0. d. TOTAL c. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-)(3A2+3Bd4)# 4. FIRST YEAR DOLLAR SAVINGS 2N3+3A+(3Bd1/(YRS ECONOMIC LIFE)) \$ 9121. 5. SIMPLE PAYBACK PERIOD (1G/4) 102.91 YEARS **\$ 135338.** 6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) 7. SAVINGS TO INVESTMENT RATIO (SIR)=(6 / 10)= .14 (IF < 1 PROJECT DOES NOT QUALIFY)

R. ADJUSTED INTERNAL RATE OF RETURN (AIRR):

-6.51 %

LIFE CYCLE COST ANALYSIS SUMMARY STUDY: FLWSTOR ENERGY CONSERVATION INVESTMENT PROGRAM (ECIF) LCCID FY95 (92) INSTALLATION & LOCATION: FORT LEOMARD WREGION NOS. 7 CENSUS: 2 PROJECT NO. & TITLE: 930073-0017 COLD THERMAL STORAGE ANALYSIS FISCAL YEAR 1996 DISCRETE PORTION NAME: ECO IH-4 ANALYSIS DATE: 08-21-95 ECONOMIC LIFE 20 YEARS PREPARED BY: T. J. GRANT 1. INVESTMENT A. CONSTRUCTION COST \$ 972958. 96469. D. TOTAL COST (1A+1B+1C) \$ 1174666. E. SALVAGE VALUE OF EXISTING EQUIPMENT \$ 0. F. PUBLIC UTILITY COMPANY REBATE \$
G. TOTAL INVESTMENT (1D - 1E - 1F) 0. \$ 1174666. 2, ENERGY SAVINGS (+) / COST (-) DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1994 UNIT COST SAVINGS ANNUAL \$ DISCOUNT DISCOUNTED MWH/YR(2) SAVINGS(3) FACTOR(4) SAVINGS(5) FUEL #/ MWH(1) -217, \* \$ -86061. -5419. 15.98 A. ELECT \$ 25.00 () " () " 19.16 \$ 0. B. DIST \$ .00 (\_) <sub>#</sub> **\$** 21,43 \$ () <sub>e</sub> C. RESID \$ .00 \$ 0. 18.30 \$ . O., D. NAT G \$ .00 16.62 \$ 0. 0. 45 () , E. COAL \$ " () () 0. \$ . 0. \$ 48317. 18.20 \$ F. PPG \$ .00 14.88 \* 718957. M. DEMAND SAVINGS **4** 432894. -217. \$ 42898. N. TOTAL 3. NON ENERGY SAVINGS(+) / COST(-) 0. A. ANNUAL RECURRING (+/-) (1) DISCOUNT FACTOR (TABLE A) 14,88 () " (2) DISCOUNTED SAVING/COST (3A X 3A1) B. NON RECURRING SAVINGS(+) / COSTS(-) SAVINGS(+) YR DISCRIT DISCOUNTED COST(-) OC FACTR
(1) (2) (3) SAVINGS(+)/ ITEM COST(-)(4)0 , d. TOTAL **\$** 0. C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-)(3A2+3Bd4)\* 4. FIRST YEAR DOLLAR SAVINGS 2N3+3A+(3Bd1/(YRS ECONOMIC LIFE))\* 27.38 YEARS 5. SIMPLE PAYBACK PERIOD (16/4) 6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) **\$** 632896. 7. SAVINGS TO INVESTMENT RATIO (SIR)=(6 / 16)= 54 (IF < 1 PROJECT DOES NOT QUALIFY) -.14 % S. ADJUSTED INTERNAL RATE OF RETURN (AIRR):

LIFE CYCLE COST ANALYSIS SUMMARY STUDY: FLWSTOR ENERGY CONSERVATION INVESTMENT PROGRAM (ECIF) LCCID FY95 (92) INSTALLATION & LOCATION: FORT LEONARD WREGION NOS. 7 CENSUS: 2 PROJECT NO. & TITLE: 930073-0017 COLD THERMAL STORAGE ANALYSIS FISCAL YEAR 1996 DISCRETE PORTION NAME: ECO IH-5 ANALYSIS DATE: 08-21-95 ECONOMIC LIFE 20 YEARS PREPARED BY: T. J. GRANT 1. INVESTMENT A. CONSTRUCTION COST \$ 877121. E. SALVAGE VALUE OF EXISTING EQUIPMENT \$ 0. F. PUBLIC UTILITY COMPANY REBATE \$ 0. F. PUBLIC UTILITY COMPANY REBATE \$ **\$** 1067969. G. TOTAL INVESTMENT (1D - 1E - 1F) 2. ENERGY SAVINGS (+) / COST (-) DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1994 UNIT COST SAVINGS ANNUAL \$ DISCOUNT DISCOUNTED \$/ MWH(1) MWH/YR(2) SAVINGS(3) FACTOR(4) SAVINGS(5) FUEL #/ MWH(1) X. NON EMERGY SAVINGS(+) / COST(-) 0. A. ANNUAL RECURRING (+/-) (1) DISCOUNT FACTOR (TABLE A) 14.88 0 , (2) DISCOUNTED SAVING/COST (3A X 3A1) B. NON RECURRING SAVINGS(+) / COSTS(-) SAVINGS(+) YR DISCNT DISCOUNTED

COST(-) OC FACTR SAVINGS(+)/

(1) (2) (3) COST(-)(4) SAVINGS(+)/ ITEM  $\circ$  . \$ 0. d. TOTAL C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-)(3A2+3Bd4)\$ O., 4. FIRST YEAR DOLLAR SAVINGS 2N3+3A+(3Bd1/(YRS ECONOMIC LIFE))\$ 46956. 22.74 YEARS 5. SIMPLE PAYBACK PERIOD (16/4) \$ 697342. 6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) 7. SAVINGS TO INVESTMENT RATIO (SIR)=(6 / 16)= .65 (IF < 1 PROJECT DOES NOT QUALIFY) .85 % 8. ADJUSTED INTERNAL RATE OF RETURN (AIRR):

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LIFE CYCLE COST ANALYSIS SUMMARY
     ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) LCCID 'FY95 (92)
INSTALLATION & LOCATION: FORT LEONARD WREGION NOS. 7 CENSUS: 2
PROJECT NO. & TITLE: 930073-0017 COLD THERMAL STORAGE ANALYSIS
FISCAL YEAR 1996 DISCRETE PORTION NAME: ECO IT-1
ANALYSIS DATE: 08-21-95 ECONOMIC LIFE 20 YEARS PREPARED BY: T. J. GRANT
1. INVESTMENT
A. CONSTRUCTION COST $ 400815.

B. SIGH $ 65060.

C. DESIGN COST $ 70974.

D. TOTAL COST (1A+1B+1C) $ 536849.
E. SALVAGE VALUE OF EXISTING EQUIPMENT $

F. PUBLIC UTILITY COMPANY REBATE $

G. TOTAL INVESTMENT (1D - 1E - 1F) $

$ 53684
                                                 $ 536849.
G. TOTAL INVESTMENT (1D - 1E - 1F)
2. ENERGY SAVINGS (+) / COST (-)
DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1994
            UNIT COST SAVINGS ANNUAL $ DISCOUNT DISCOUNTED
$/ MWH(1) MWH/YR(2) SAVINGS(3) FACTOR(4) SAVINGS(5)
          $/ MWH(1)
    FUEL
    $ 14918.
11. $ 15200.
                                                               $ 226452.
    N. TOTAL
3. NON ENERGY SAVINGS(+) / COST(-)
                                                                        0.
                                                      14.88
   A. ANNUAL RECURRING (+/-)
       MANGHE RECORKING (+/-)
(1) DISCOUNT FACTOR (TABLE A)
                                                                    () "
       (2) DISCOUNTED SAVING/COST (3A X 3A1)
   A. MON RECURRING SAVINGS(+) / COSTS(-)
                            SAVINGS(+) YR DISCNT DISCOUNTED COST(-) OC FACTR SAVINGS(+)/
                             COST(-) OC FACTR
(1) (2) (3)
                ITEM
                                                          COST(-)(4)
                             $ 0,
   d. TOTAL
   C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-)(3A2+3Bd4)$
4. FIRST YEAR DOLLAR SAVINGS 2N3+3A+(3Bd1/(YRS ECONOMIC LIFE))$ 15200.
                                                                 35.32 YEARS
5. SIMPLE PAYBACK PERIOD (16/4)
                                                              $ 224452.
6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C)
7. SAVINGS TO INVESTMENT RATIO (SIR)=(6 / 16)=
   (IF < 1 PROJECT DOES NOT QUALIFY)
8. ADJUSTED INTERNAL RATE OF RETURN (AIRR):
                                                                 -1.35 %
```

STUDY: FLWSTOR

STUDY: FLWSTOR LIFE CYCLE COST ANALYSIS SUMMARY ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) LCCID FY95 (92)
INSTALLATION & LOCATION: FORT LEONARD WREGION NOS. 7 CENSUS: 2 PROJECT NO. & TITLE: 930073-0017 COLD THERMAL STORAGE ANALYSIS FISCAL YEAR 1996 DISCRETE PORTION NAME: ECO IT-2 ANALYSIS DATE: 08-21-95 ECONOMIC LIFE 20 YEARS PREPARED BY: T. J. GRANT 1. INVESTMENT A. CONSTRUCTION COST \$ 500510. 500510. \$ 70543. # − B. SIOH C. DESIGN COST D. TOTAL COST (1A+1B+1C) \$ 648009. 0. 0. E. SALVAGE VALUE OF EXISTING EQUIPMENT \$ F. PUBLIC UTILITY COMPANY REBATE \$ 648009. G. TOTAL INVESTMENT (1D - 1E - 1F) 2. EMERGY SAVINGS (+) / COST (-) DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1994 UNIT COST SAVINGS ANNUAL \$ DISCOUNT DISCOUNTED #/ MWH(1) MWH/YR(2) SAVINGS(3) FACTOR(4) SAVINGS(5) FILEL 1853. 29426. 15,88 \$ 74. A. ELECT \$ 25.00 () <sub>n</sub> 19.16 \$ () " \$ 0. B. DIST \$ .00 " () (°) 0 .. 21,43 \$ 0. \$ O. C. RESID \$ 0. \$ 0. 0. \$ 0. 0. \$ 0. \$ 18110. 18.30 \$ D. NAT 8 \$ .00 0. 16.62 \$ 18.20 \$ () . E. COAL \$ .00 (°) F. PPG \$ .00 14.88 \$ 269477. M. DEMAND SAVINGS 74. \$ 19963. 298903. N. TOTAL 3. NON EMERGY SAVINGS(+) / COST(-) A. ANNUAL RECURRING (+/-) (1) DISCOUNT FACTOR (TABLE A) 14,88 0 " (2) DISCOUNTED SAVING/COST (3A X 3A1) B. NON RECURRING SAVINGS(+) / COSTS(-) SAVINGS(+) YR DISCNT COST(-) OC FACTR DISCOUNTED SAVINGS(+)/ ITEM (1) (2) (3) COST(-)(4)\$ 0. 0. d. TOTAL C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-)(3A2+3Bd4)\$ 4. FIRST YEAR DOLLAR SAVINGS 2N3+3A+(3Bd1/(YRS ECONOMIC LIFE))\$ 32.46 YEARS 5. SIMPLE PAYBACK PERIOD (16/4) 298903. 6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) (SIR) = (6 / 16) =.46 7. SAVINGS TO INVESTMENT RATIO (IF < 1 PROJECT DOES NOT GUALIFY)

AL ADMURTED INTERNAL RATE OF RETURN (AIRR):

-.91 %

LIFE CYCLE COST ANALYSIS SUMMARY STUDY: FLWSTOR ENERGY CONSERVATION INVESTMENT PROGRAM (ECIF) LCCID FY95 (92) INSTALLATION & LOCATION: FORT LEONARD WREGION NOS. 7 CENSUS: 2 PROJECT NO. & TITLE: 930073-0017 COLD THERMAL STURAGE ANALYSIS FISCAL YEAR 1996 DISCRETE PORTION NAME: ECO IT-3 ANALYSIS DATE: 08-21-95 ECONOMIC LIFE 20 YEARS PREPARED BY: T. J. GRANT 1. INVESTMENT A. CONSTRUCTION COST \$ 859365.

B. SIOH \$ 90423.

C. DESIGN COST \$ 98643. D. TOTAL COST (1A+1B+1C) \$ 1048431. E. SALVAGE VALUE OF EXISTING EQUIPMENT \$ 0. F. PUBLIC UTILITY COMPANY REBATE \$ 0. G. TOTAL INVESTMENT (1D - 1E - 1F) \$ 104845 \$ 1048431. 2. ENERGY SAVINGS (+) / COST (-) DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1994 UNIT COST SAVINGS ANNUAL \$ DISCOUNT DISCOUNTED \$/ MWH(1) MWH/YR(2) SAVINGS(3) FACTOR(4) SAVINGS(5) 3. NON ENERGY SAVINGS(+) / CDST(-) 0. A. ANNUAL RECURRING (+/-) (1) DISCOUNT FACTOR (TABLE A) 14.88 0. (2) DISCOUNTED SAVING/COST (3A X 3A1) B. NON RECURRING SAVINGS(+) / COSTS(-) SAVINGS(+) / COSTS(-)
SAVINGS(+) YR DISCNT DISCOUNTED

COST(-) OC FACTR SAVINGS(+)/

(1) (2) (3) COST(-)(4) ITEM \$ 0. d. TOTAL C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-)(3A2+3Bd4)\$ 0. 4. FIRST YEAR DOLLAR SAVINGS 2N3+3A+(3Bd1/(YRS ECONOMIC LIFE))\$ 48552. 21.59 YEARS 5. SIMPLE PAYBACK PERIOD (16/4) \$ 72268**4.** 6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) 7. SAVINGS TO INVESTMENT RATIO (SIR)=(6 / 16)= .69 (IF < 1 PROJECT DOES NOT GUALIFY)

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR): 1.10 %

LIFE CYCLE COST ANALYSIS SUMMARY STUDY: FLWSTOR ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) LCCID FY95 (92) INSTALLATION & LOCATION: FORT LEONARD WREGION NOS. 7 CENSUS: 2 PROJECT NO. & TITLE: 930073-0017 COLD THERMAL STORAGE ANALYSIS FISCAL YEAR 1996 DISCRETE PORTION NAME: ECO IT-4 ANALYSIS DATE: 06-21-95 ECONOMIC LIFE 20 YEARS PREPARED BY: T. J. GRANT 1. INVESTMENT A. CONSTRUCTION COST \$ 787991.
B. SIGH \$ 86433.
C. DESIGN COST \$ 94290. D. TOTAL COST (1A+1B+1C) \$ 968714. E. SALVAGE VALUE OF EXISTING EQUIPMENT \$

F. PUBLIC UTILITY COMPANY REBATE \$

C. TOTAL INVESTMENT (1D - 1E - 1F) \$

968714. G. TOTAL INVESTMENT (1D - 1E - 1F) 2. ENERGY SAVINGS (+) / COST (-) DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1994 UNIT COST SAVINGS ANNUAL \$ DISCOUNT DISCOUNTED \$/ MWH(1) MWH/YR(2) SAVINGS(3) FACTOR(4) SAVINGS(5) T. NON ENERGY SAVINGS(+) / COST(-) 0. A. ANNUAL RECURRING (+/-) (1) DISCOUNT FACTOR (TABLE A) 14.88 0. (2) DISCOUNTED SAVING/COST (3A X 3A1) B. NON RECURRING SAVINGS(+) / COSTS(-) S(+) / COSTS(-)
SAVINGS(+) YR DISCNT DISCOUNTED
COST(-) OC FACTR SAVINGS(+)/
(1) (2) (3) COST(-)(4) ITEM \$ 0. d. TOTAL C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-)(3A2+3Bd4)\$ 4. FIRST YEAR DOLLAR SAVINGS 2N3+3A+(3Bd1/(YRS ECONOMIC LIFE))\$ 19.63 YEARS 5. SIMPLE PAYBACK PERIOD, (18/4) 735463. 6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) 7. SAVINGS TO INVESTMENT RATIO (SIR)=(6 / 16)= .76 (IF < 1 PROJECT DOES NOT QUALIFY) 8. ADJUSTED INTERNAL RATE OF RETURN (AIRR): 1.59 %

LIFE CYCLE COST ANALYSIS SUMMARY STUDY: FLWSTOR ENERGY CONSERVATION INVESTMENT PROGRAM (ECIF) LCCID FY95 (92) INSTALLATION & LOCATION: FORT LEONARD WREGION NOS. 7 CENSUS: 2 PROJECT NO. & TITLE: 930073-0017 COLD THERMAL STORAGE ANALYSIS FISCAL YEAR 1996 DISCRETE PORTION NAME: ECO IT-5 ANALYSIS DATE: 08-21-95 ECONOMIC LIFE 20 YEARS PREPARED BY: T. J. GRANT 1. INVESTMENT A. CONSTRUCTION COST \$ 599942. D. TOTAL COST (1A+1B+1C) \$ 759010. E. SALVAGE VALUE OF EXISTING EQUIPMENT \$
F. PUBLIC UTILITY COMPANY REBATE \$
G. TOTAL INVESTMENT (1D - 1E - 1F) ()<sub>n</sub> , . . O. 759010. 2. ENERGY SAVINGS (+) / COST (-) DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1994 UNIT COST SAVINGS ANNUAL \$ DISCOUNT DISCOUNTED \$/ MWH(1) MWH/YR(2) SAVINGS(3) FACTOR(4) SAVINGS(5) 19954. 19.16 \$ () <sub>#</sub> 21.43 \$ 0. 18.30 \$ 0. 16.62 \$ 0. 18.20 \$ 0. 14.88 \$ 718957. \$ 738911**.** 3. NON EMERGY SAVINGS(+) / COST(-) 0. A. ANNUAL RECURRING (+/-) (1) DISCOUNT FACTOR (TABLE A) 14.88 (2) DISCOUNTED SAVING/COST (3A X 3A1) 0. B. NON RECURRING SAVINGS(+) / COSTS(-) SAVINGS(+) /R DISCNT DISCOUNTED

COST(-) OC FACTR SAVINGS(+)/

(1) (2) (3) COST(-)(4) ITEM \$ 0. d. TOTAL C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-)(3A2+3Bd4)\$ 0. 4. FIRST YEAR DOLLAR SAVINGS 2N3+3A+(3Bd1/(YRS ECONOMIC LIFE))\$ 49574. 15.31 YEARS 5. SIMPLE PAYBACK PERIOD (16/4) 6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) 738911. 7. SAVINGS TO INVESTMENT RATIO (SIR)=(6 / 1G)= (IF < 1 PROJECT DOES NOT QUALIFY) 8. ADJUSTED INTERNAL RATE OF RETURN (AIRR): 2.86 %

As can be seen, none of the ECO's meet the required SIR hurdle of 1.25, including the "optimized" cases. The conclusion is that cold thermal storage is a non-feasible approach to reducing utility costs at Fort Leonard Wood. The reasons for this are very basic.

First, cold thermal storage systems are extremely expensive to install, compared to conventional chilled water generators such as centrifugal chillers. The difference in first costs can be amortized over a reasonable period of time, but only if demand and energy charges avoided are high, such as exist on the east coast of the United States. However, the rates being charged at Fort Leonard Wood are among the lowest in the country. The accompanying table, from the 7/95 issue of Energy User News, reflects this. It shows that, at the current rate of 2.50 cents per KWHR, had Ft. Leonard Wood's utility company been included in this list it would have been one of the cheapest rates in the country, ranking in the top 2.5% of those listed. While this table reflects energy charges only, it is generally the case that energy rates and demand rates go hand-in-hand. Such systems can also be made feasible if the local utility has financing or cash contribution incentives which can be applied against first costs. However, the local utility has no such programs available.

A contributing factor which hurts the viability of cold thermal storage is the need to have cooling available at night for the Barracks buildings. Most cold thermal storage systems are successfully employed only on buildings which have a regular "down time" such as office buildings, which are closed at nights and over weekends. Such downtime allows the ice system to devote itself exclusively to re-charging of the ice tanks, without the need to simultaneously provide cooling. Such a need for concurrent cooling drives the installed cost of the system up very significantly.

#### RANKING OF ELECTRICITY PRICES INDUSTRIAL Cts/Arwh State UTU ITY Cum huch Cts/krwk State UTILITY 86. 87. 1. 2. 3. 4. 5. 6. 7. 8. 9. 10. Hawaii Elec. Light Delmarva P&L 12.71 Hi 0.0% 4.40 De 47.3% 11.20 Consolidated Edison NY 0.1% 4 36 F 47.5% Gulf Power 88. 89. 90. 4.34 4.34 10.86 Hi Maui Electric 0.2% Mn Northern States Power 49.4% 9.98 Northern States Power NH P.S. New Hampshire 0.4% ND 49.5% 9.82 4.32 V. Ma Commonwealth Elec. 0.4% Virginia E&P 50.7% Blackstone Valley Elec. 4.27 9.21 RI 0.5% Ga Georgia Power 53.9% 4.23 8.87 Ct United Illum 0.6% 92 Az Salt River Project 54.3% Hi Co 8.78 Hawaiian Electric 1.0% 93. 94. 95. 96. 4.23 54.4% 57.3% UtiliCorp United 8.51 Ma W. Massachusetts Elec. 1.1% 4.19 Tx Texas Utilies Elec. 8.49 F N Jersey Central P&L . 1.6% 4.17 In Indianapolis P&L 58.1% 11. 12 8.46 Ma Boston Edison 1.8% 4.16 Northern Indiana P.S. 59.4% In 8.30 N Atlantic City Electric 1.9% 97. 4.16 SC. South Carolina E&G 60.0% 13. 14. 15. 16. 17. 18. 19. 20. 21. 22. 23. 24. 25. 26. 27. 28. 30. 31. 32. 33. 34. 35. 8.21 C Los Angeles Dept W&P 2.6% 98. In 4.16 Indiana/Mich. Pwr. 60.8% Central Maine Power 8.21 Me 3.1% 99. 4.16 61.5% Union Electric NO 7.80 Public Service E&G 100. 4.15 Tn 61.7% Memphis agency 7.64 Connecticut L&P 4.7% 101. 4.14 NC Duke Power Co. 63.8% 7.63 RI Narragansett Elec. 4.8% 102. 4.09 Mo St. Joseph L&P 63.9% 7.51 Pa Peco Energy 6.8% 103. 4.05 La New Orleans P.S. 64.0% 7.42 Bangor Hydroelectric 104. 105. Me 6.9% 4.04 Co Ft. Collins L&P 64.0% 3.97 712 Ga NY Orange/Rockland Utils. 7.0% Savannah E&P 64.1% 3.96 Sacramento MUD 6.64 6.51 CA 7.5% 106. i Ma Kansas City P&L 64.4% C 3.93 S. Calif. Edison 10.7% 107. NM Southwestern PS 64.6% 6.41 Central Vermont P.S. 3.93 DC 10.3% 64.6% 108. Potomac Electric 6.38 109. Az Tucson Elec. Power 10.7% 3.90 La C. Louisiana Elec. 64.9% 6.32 Oh 110. Cleveland Elec. Illum. 11.6% 3.89 Wi Wisconsin Elec. Power 66.0% 6.20 Ca San Diego G&E 12.0% 111. 3.88 Co Colorado Spr. Util. 66.2% 6.17 Ca Pacific G&E 14.5% 112. 3.88 la Midwest Pwr Sys 66.5% 6.15 Ma Massachusetts Elec. 15.0% 113. 3.87 PacifiCorp 67.1% 6.10 n Commonwealth Edison 17.9% 114. 3.87 Or Portland GE 67.6% Ωħ 5.85 Ohio Edison 19.2% 115. 3.85 Π C. Illinois Light 67.9% Pa ! 5.84 3.84 Duquesne Light 19 6% 116. SC Duke Power Co. 69.4% Ak Md 5.71 Golden Valley Elec. Delmarva P&L 3.83 Ks Kansas City BPU 69.5% 19.6% 117. 5.58 3.82 wv Appalachian Power 70.1% 19.6% 118 Ms 5.53 119. City Utilities Mississippi P&L 20.0% 3.81 Mo. 70.1% 5.50 Detroit Edison 120. 3.80 Mi Al. Alabama Power 72.7% 36. 37. 38. 39. 40. 5.45 Αr 22.5% 121. 3.80 Ne: Arkansas P&L Lincoln Elec. System Vt 5.43 Green Mountain Power 22.6% 122 3.76 AI: Decatur Utilities 72.8% 5.40 5.38 Pa 3.76 Pennsylvania P&L 73 8% 123 Ne Grand Island Elec. 72.9% Mi Consumers Power 25.4% 124. 3.70 Wa PUD No. 1 Snohomish 73.0% 5.35 5.31 Washington Water Pwr. NV Sierra Pacific Power 25.8% 125. 3.68 Wa 73.1% 41. 42. 43. 44. 45. NM 3.63 PS New Mexico 25.8% 126 Minnesota P&I. Mn 74.0% Ut la Wi PacifiCorp 5.29 3.62 74.8% E Az Arizona PS 26.4% 127. 5.18 Ga Cobb Electric 26.4% 3.62 Iowa-Illinois G&E 75.0% 128 5.07 129. NY Niagara Mohawk Pwr. 27.9% 3.62 Wisconsin P&L 75.5% NY 5.06 Central Hudson G&E 28.0% 130. 3.61 In S. Indiana G&E 75.7% NC NC 46. 5.05 131 3.59 La Fayetteville PW 28.1% Louisiana P&L 77.7% 47. 18. 5.04 Carolina P&L 29.5% 132. 3.58 "Cheyenne L, F&P" 77.**7**% 5.02 Md Baltimore Gas & Elec. 31.1% 133 3.55 Ky Mt Louisville G&E 78.1% 49. 50. 51. 52. 53. 54. 55. 5.00 F Florida Power 31.5% 134 3.55 **PacifiCorp** 78.1% Tn WV Volunteer Elec Coop 3.54 3.53 4.98 31.5% 135. In PSI Energy 79.3% 4 94 Mississippi Pwr 79.8% Potomac Edison 31.6% 136. Ms 4.92 3.50 Ks. la Ok Kansas City P&L 31.7% 137. Interstate Power 80.1% 4.91 Florida P&L 3.48 PS Oklahoma 138 80.7% 4.89 A. Huntsville agency 32.3% 139. 3.48 Va: Appalachian Power 81.4% Oh: 140. 3.43 Tx. Ar Ky Gulf States Utilities 4.88 Columbus S. Power 32.7% 82.2% 56. 57. 4.87 Tn Nashville Elec. Svc. 33.4% 141. 3.41 Southwestern Elec. Pwi 82.4% 4.86 142. 3.41 Kentucky Utilities 82.9% Western Resources 34.1% 58. 59. 60. 61. 62. 63. 64. 65. 66. 34.1% 4.85 ND MDU Resources 143. 3.39 IA. IES Utilities 83.4% SC: Tn 4.85 Carolina P&L 34.5% 144. 3.38 Tx: Central Power & Light 84.4% Knoxville Agency 3.37 3.37 3.36 Wy Wa Mo 145. 4.85 34.8% PacifiCorp 85.1% 4.80 4.79 Wa 146. 147. Seattle City Light Puget Sound P&L 35.3% 85.3% Empire District Elec. 85.4% r Ga 35.4% Jackson Elec. 4.79 1 · II 3.36 Ne Ne 148. Nebraska PPD 85.5% Illinois Power 36.4% Nv. Nevada Power 149. 3.28 Omaha PPD 85.7% 36.9% 4.70 37.9% 150. 3.24 NM 85.9% Pa West Penn Power Texas-N.M. Power 4.69 151. 3.20 Wi Wisconsin PS 86.3% NC: Virginia E&P 38.1% 4.66 Mi Indiana/Mich. Pwr. 152 3.19 Md: Potomac Edison 86.9% 38.2% 67.3% 68. 69. 70. 71. 72. 73. 74. 75. 76. 77. 78. 4.64 Mď Potomac Electric 38.2% 153. 3.18 Mt: Montana Power 4.61 4.59 ND, Otter Tail Power 38.3% 154. 3.17 a Id SC Washington Water Pwr 87.4% Tx Austin agency Gulf States Utilities 38.4% 155. 3.05 SC Public Svc. Auth. 88 1% Ok 4.59 Oklahoma G&E L 3.03 88.8% 39.4% 156. 2.97 4.58 Tn Chattanooga agency 39.8% 157 Oh Ohio Power 91.5% 4.57 2.97 Grand River Dam Auth. Co PS Colorado 40.5% Ok 158 91.5% PUD #1 Clark Cty. 4.57 Wi Northern States Power 159. 2.96 Wa. 40.8% 91.6% Oh. Cincinnati G&E 41.5% 160. 2.94 Kentucky Power Co. 92.0% Ky 4.55 161. 2.91 Tacoma DPU Mi Lansing Bd. W&L 41.6% 92.4% PacifiCorp 4.54 SD Black Hills Corp. 2.68 Id 41.6% 162 92.6% 4.53 FI 163. 2.68 Green River Electric 93.1% Tampa Elec. 42.0% Кy Northwestern P.S. 4.49 SD 42.0% 164 2.66 Or Bonneville Power Admin93.5% 165. Bonneville Power Admin93.8% 4.49 Tx San Antonio PS Bd. 42.4% 2.57 Mt 81. 82. 166. 167. 2.56 Id Idaho Power 4.47 Tx Houston L&P 45.8% 94.4% 4 43 2 55 Wa Bonneville Power Admin 96.2% Mn Otter Tail Power 45.9% NY State Power Auth. 83. 4.43 п C. Illinois PS "Union L, H&P" 2.06 96.8% NY 46.2% 168 <sup>k</sup> Ky

These prices represent what electric utilities charged industrial customers in March 1995, based on dividing total revenue by total leven sold to these customers. These prices may not reflect what individual customers were charged. Prices include demand, power, and fuel adjustment charges. Where possible, special rate programs for large customers have been eliminated to more closely represent actual per livrit costs to most customers. Some utilities make arbitrary one-morth adjustments in revenue balled that do not correspond to what customers were billed. The cumulative kwh percentile tells what percent of the surveyed utilities' total livrit was solid by the individual utility and those above it ranking as more costly. Source: DOE form EIA-826 and EUN survey, . 4.

169.

1.74

1.67

Ky

Οĥ

Elec. Energy Inc.

Ohio Valley Electric

97.8%

100.0%

46.3%

46.9%

Monongahela Power

the trace of the state of the state of

84.

974

4.41

# COE LIMITED ENERGY STUDY THERMAL STORAGE AT CENTRAL CHILLED WATER PLANT FORT LEONARD WOOD, MISSOURI 930073-0017

May 31, 1996

### APPENDIX

APPENDIX A	SCOPE OF WORK
APPENDIX B	DETAILED SYSTEM SIZING PROCEDURES AND CALCULATIONS
APPENDIX C	MANUFACTURER'S LITERATURE
APPENDIX D	COOLING LOAD AND DEMAND PROFILE PRINTOUTS
APPENDIX E	DETAILED ENERGY AND DEMAND DEVELOPMENT AND CALCULATIONS
APPENDIX F	ENERGY USAGE AND PEAK DEMAND COMPUTER PRINTOUTS
APPENDIX G	CONCEPTUAL COST ESTIMATES
APPENDIX H	LIFE CYCLE COST ANALYSIS COMPUTER PRINTOUTS

END OF APPENDIX

# APPENDIX A

SCOPE OF WORK

MRK-ED-MF

3 MAY 1994 REVISED 11 JULY 1994 REVISED 25 AUGUST 1994

GENERAL SCOPE OF WORK

FOR A

LIMITED ENERGY STUDY

THERMAL STORAGE AT

CENTRAL CHILLED WATER PLANT

FORT LEONARD WOOD, MISSOURI

Performed as part of the ENERGY ENGINEERING ANALYSIS PROGRAM (EEAP)

- 1. BRIEF DESCRIPTION OF WORK: The Architect-Engineer (AE) shall:
- 1.1 Review the previously completed Energy Engineering Analysis Program (EEAP) study which applies to the specific building, system, or energy conservation opportunity (ECO) covered by this study.
- 1.2 Perform a limited site survey of specific buildings or areas to collect all data required to evaluate the specific ECOs included in this study.
- 1.3 Reevaluate the specific project or ECO from the previous study to determine its economic feasibility based on revised criteria, current site conditions and technical applicability.
- 1.4 Evaluate specific ECOs to determine their energy savings potential and economic feasibility.
- 1.5 Provide project documentation for recommended ECOs as detailed herein.
- 1.6 Prepare a comprehensive report to document all work performed, the results and all recommendations.

### 2. GENERAL

- 2.1 This study is limited to the evaluation of the specific buildings, systems, or ECOs listed in Annex A, DETAILED SCOPE OF WORK.
- 2.2 The information and analysis outlined herein are considered to be minimum requirements for adequate performance of this study.
- 2.3 For the buildings, systems or ECOs listed in Annex A, all methods of energy conservation which are reasonable and practical shall be considered, including improvements of operational methods and procedures as well as the physical facilities. All energy conservation opportunities which produce energy or dollar savings shall be documented in this report. Any energy conservation opportunity considered infeasible shall also be documented in the report with reasons for elimination.
- 2.4 The study shall consider the use of all energy sources applicable to each building, system, or ECO.
- 2.5 The "Energy Conservation Investment Program (ECIP) Guidance", described in letter from DAIM-FDF-U, dated 10 January 1994 establishes criteria for ECIP projects and shall be used

for performing the economic analyses of <u>all</u> ECOs and projects. The program, Life Cycle Cost In Design (LCCID), has been developed for performing life cycle cost calculations in accordance with ECIP guidelines and is referenced in the ECIP Guidance. If any program other than LCCID is proposed for life cycle cost analysis, it must use the mode of calculation specified in the ECIP Guidance. The output must be in the format of the ECIP LCCA summary sheet, and it must be submitted for approval to the Contracting Officer.

- 2.6 Computer modeling will be used to determine the energy savings of ECOs which would replace or significantly change an existing heating, ventilating, and air-conditioning (HVAC) system. The rquirement to use computer modeling applies only to heated and air-conditioned or air-conditioned-only buildings which exceed 8,000 square feet or heated-only buildings in excess of 20,000 square feet. Modeling will be done using a professionally recognized and proven computer program or features architectural integrate programs that air-conditioning, heating, lighting and other energy-producing or consuming systems. These programs will be capable of simulating the features, systems, and thermal loads of the building under study. The program will use established weather data files and may perform calculations on a true hour-by-hour basis or may condense the weather files and the number of calculations into several "typical" days per month. The Detailed Scope of Work, Annex A, will list programs that are acceptable to the Contracting Officer. If the AE desires to use a different program, it must be submitted for approval with a sample run, an explanation of all input and output data, and a summary of program methodology and energy evaluation capabilities.
- 2.7 Energy conservation opportunities determined to be technically and economically feasible shall be developed into projects acceptable to installation personnel. This may involve combining similar ECOs into larger packages which will qualify for ECIP, MCA, or PCIP funding, and determining in coordination with installation personnel the appropriate packaging and implementation approach for all feasible ECOs.
- 2.7.1 Projects which qualify for ECIP funding shall be identified, separately listed, and prioritized by the Savings to Investment Ratio (SIR).
- 2.7.2 All feasible non-ECIP projects shall be ranked in order of highest to lowest SIR.
- 2.7.3 At some installations Energy Conservation and Management (ECAM) funding will be used instead of ECIP funding. The criteria for each program is the same. The Director of Engineering and Housing will indicate which program is used at this installation. This Scope of Work mentions only ECIP,

however, ECAM is also meant.

### 3. PROJECT MANAGEMENT

- 3.1 Project Managers. The AE shall designate a project manager to serve as a point of contact and liaison for work required under this contract. Upon award of this contract, the individual shall be immediately designated in writing. The AE's designated project manager shall be approved by the Contracting Officer prior to commencement of work. This designated individual shall be responsible for coordination of work required under this contract. The Contracting Officer will designate a project manager to serve as the Government's point of contact and liaison for all work required under this the Government's individual will be This contract. representative.
- 3.2 <u>Installation Assistance</u>. The Commanding Officer or authorized representative at the installation will designate an individual to assist the AE in obtaining information and establishing contacts necessary to accomplish the work required under this contract. This individual will be the installation representative.
- 3.3 <u>Public Disclosures</u>. The AE shall make no public announcements or disclosures relative to information contained or developed in this contract, except as authorized by the Contracting Officer.
- 3.4 Meetings. Meetings will be scheduled whenever requested by the AE or the Contracting Officer for the resolution of questions or problems encountered in the performance of the work. The AE's project manager and the Government's representative shall be required to attend and participate in all meetings pertinent to the work required under this contract as directed by the Contracting Officer. These meetings, if necessary, are in addition to the presentation and review conferences.
- 3.5 <u>Site Visits, Inspections, and Investigations</u>. The AE shall visit and inspect/investigate the site of the project as necessary and required during the preparation and accomplishment of the work.

### 3.6 Records

3.6.1 The AE shall provide a record of all significant conferences, meetings, discussions, verbal directions, telephone conversations, etc., with Government representative(s) relative to this contract in which the AE and/or designated representative(s) thereof participated. These records shall be dated and shall identify the contract number, and modification

number if applicable, participating personnel, subject discussed and conclusions reached. The AE shall forward to the Contracting Officer within ten calendar days, a reproducible copy of the records.

- 3.6.2 The AE shall provide a record of requests for and/or receipt of Government-furnished material, data, documents, information, etc., which if not furnished in a timely manner, would significantly impair the normal progression of the work under this contract. The records shall be dated and shall identify the contract number and modification number, if applicable. The AE shall forward to the Contracting Officer within ten calendar days, a reproducible copy of the record of request or receipt of material.
- 3.7 <u>Interviews</u>. The AE and the Government's representative shall conduct entry and exit interviews with the Director of P(ublic Works before starting work at the installation and after completion of the field work. The Government's representative shall schedule the interviews at least one week in advance.
- 3.7.1 Entry. The entry interview shall describe the intended procedures for the survey and shall be conducted prior to commencing work at the facility. As a minimum, the interview shall cover the following points:
  - a. Schedules.
  - b. Names of energy analysts who will be conducting the site survey.
  - c. Proposed working hours.
  - d. Support requirements from the Director of Public Works.
- 3.7.2 Exit. The exit interview shall briefly describe the items surveyed and probable areas of energy conservation. The interview shall also solicit input and advice from the Director of Public Works.
- 4. <u>SERVICES AND MATERIALS</u>. All services, materials (except those specifically enumerated to be furnished by the Government), plant, labor, supervision and travel necessary to perform the work and render the data required under this contract are included in the lump sum price of the contract.
- 5. <u>PROJECT</u> <u>DOCUMENTATION</u>. All energy conservation opportunities which the AE has considered shall be included in one of the following categories and presented in the report as such:

- 5.1 ECIP Projects. To qualify as an ECIP project, an ECO, several ECOs which have been combined, must have a construction cost estimate greater than \$300,000, a Savings to Investment Ratio greater than 1.25 and a simple payback period of less than ten years. For ECAM projects, the \$300,000 limitation may not apply; in such cases, the AE shall check with The overall project and each the installation for guidance. discrete part of the project shall have an SIR greater than one. All projects meeting the above criteria shall be arranged as specified in paragraph 2.7.1 and shall be provided with programming documentation. Programming documentation shall consist of a DD Form 1391, life cycle cost analysis (LCCA) summary sheet(s) (with necessary backup data to verify the numbers presented), and a Project Development Brochure (PDB). A life cycle cost analysis summary sheet shall be developed for each ECO and for the overall project when more than one ECO are combined. The energy savings for projects consisting of multiple ECOs must take into account the synergistic effects of the individual ECOs.
- 5.2 Non-ECIP Projects. Projects which do not meet ECIP criteria with regard to cost estimate, payback period, or non-energy (75%) qualification test, but which have an SIR greater than one shall be documented. Projects or ECOs in this category shall be arranged as specified in paragraph 2.7.2 and shall be provided with the following documentation: the life cycle cost analysis (LCCA) summary sheet completely filled out, a description of the work to be accomplished, backup data for the LCCA, ie, energy savings calculations and cost estimate(s), and the simple payback period. The energy savings for projects consisting of multiple ECOs must take into account the synergistic effects of the individual ECOs. In addition these projects shall have the necessary documentation prepared, as required by the Government's representative, for one of the following categories:
- b. O & M Energy Projects. An O & M Energy project is one that results in needed maintenance or repair to an existing facility, or replaces a failed or failing existing facility, and also results in energy savings. The criteria are similar to the criteria—for—ECIP projects, i.e. \$ 300.000 construction cost, SIR > 1.25, and simple payback period of less than ten years. In addion, if the project would replace a sytem or equipment that is considered failed or failing" due soley to obsolete technology or inefficiency, the equipment to be replaced must have been in u for at least three years; and the simple payback period must be three years or less.
- c. Regular Military Construction Army (MCA) Program. This program is for projects which have a total cost greater than \$200,000 and a simple payback period of four to twenty-five years. Documentation shall consist of DD Form 1391 and a Project

Development Brochure.

- d. Low Cost/No Cost Projects. These are projects which the Director of Engineering and Housing (DEH) can perform using his resources. Documentation shall be as required by the DEH.
- 5.3 Nonfeasible ECOs. All ECOs which the AE has considered but which are not feasible, shall be documented in the report with reasons and justifications showing why they were rejected.
- 6. <u>DETAILED SCOPE OF WORK</u>. The Detailed Scope of Work is contained in Annex A.

# 7. WORK TO BE ACCOMPLISHED.

- 7.1 Review Previous Studies. Review the previous EEAP study which applies to the specific building, system, or ECO covered by this study. This review should acquaint the AE with the work that has been performed previously. Much of the information the AE may need to develop the ECOs in this study may be contained in the previous study.
- 7.2 Perform a Limited Site Survey. The AE shall obtain all necessary data to evaluate the ECOs or projects by conducting a site survey. However, the AE is encouraged to use any data that may have been documented in a previous study. The AE shall document his site survey on forms developed for the survey, or standard forms, and submit these completed forms as part of the report. All test and/or measurement equipment shall be properly calibrated prior to its use.
- 7.3 Reevaluate Selected Projects. The AE shall reevaluate the projects and ECOs listed in Annex A. These are projects and ECOs that the previous study has identified but that have not been accomplished or only parts have been accomplished. If the project or ECO is acceptable as is, that is, there are no changes to the basic project or ECO, the energy savings shown in the previous project may be accepted as accurate but the energy cost and construction cost estimates shall be updated based on the most current data available. With the above information the project shall then be analyzed based on current ECIP criteria. If the project or ECO is basically acceptable but some of the buildings in the original project have been deleted or new buildings can be added, the necessary changes shall be made to the energy savings, the energy costs and construction costs shall be updated, and the revised project or ECO shall then be analyzed using current ECIP guidance. If the original project or ECO has had numerous changes made to it so that all of the numbers are suspected of being inaccurate, but the project or ECO is still considered feasible, the AE shall develop the project from the beginning and analyze it with the current ECIP These projects shall be separately listed in the guidance.

report.

- 7.4 Evaluate Selected ECOs. The AE shall analyze the ECOs listed in Annex A. These ECOs shall be analyzed in detail to Savings to Investment Ratios determine their feasibility. (SIRs) shall be determined using current ECIP guidance. The AE shall provide all data and calculations needed to support the All assumptions and engineering equations recommended ECO. shall be clearly stated. Calculations shall be prepared showing how all numbers in the ECO were figured. Calculations shall be an orderly step-by-step progression from the first assumption to the final number. Descriptions of the products, manufacturers catalog cuts, pertinent drawings and sketches shall also be A life cycle cost analysis summary sheet shall be prepared for each ECO and included as part of the supporting data.
- 7.5 Combine ECOs Into Recommended Projects. During the Interim Review Conference, as outlined in paragraph [7.6.1], the AE will be advised of the DEH's preferred packaging of recommended ECOs into projects for implementation. Some projects may be a combination of several ECOs, and others may contain only one. These projects will be evaluated and arranged as outlined in paragraphs 5.1, 5.2, and 5.3. Energy savings calculations shall take into account the synergistic effects of multiple ECOs within a project and the effects of one project upon another. The results of this effort will be reported in the Final Submittal per par [7.6.2].
- 7.6 Submittals, Presentations and Reviews. The work accomplished shall be fully documented by a comprehensive report. The report shall have a table of contents and shall be indexed. Tabs and dividers shall clearly and distinctly divide sections, subsections, and appendices. All pages shall be numbered. Names of the persons primarily responsible for the project shall be included. The AE shall give a formal presentation of the interim submittal to installation, command, and other Government personnel. Slides or view graphs showing the results of the study to date shall be used during the presentation. During the presentation, the personnel in attendance shall be given ample opportunity to ask questions and discuss any changes deemed necessary to the study. A review conference will be conducted the same day, following the presentation. Each comment presented at the review conference will be discussed and resolved or action items assigned. It is anticipated that the presentation and review conference will require approximately one working day. The presentation and review conference will be at the installation on the date agreeable to the Director of the Government's and Engineering and Housing, the AE The Contracting Officer may require a rerepresentative. submittal of any document(s), if such document(s) are not approved because they are determined by the Contracting Officer

to be inadequate for the intended purpose.

- 7.6.1 Interim Submittal. An interim report shall be submitted for review after the field survey has been completed and an analysis has been performed on all of the ECOs. The report shall indicate the work which has been accomplished to date, illustrate the methods and justifications of the approaches taken and contain a plan of the work remaining to complete the study. Calculations showing energy and dollar savings, SIR, and simple payback period of all the ECOs shall be included. The results of the ECO analyses shall be summarized by lists as follows:
- a.All ECOs eliminated from consideration shall be grouped into one listing with reasons for their elimination as discussed in par 5.3.
- b.All ECOs which were analysed shall be grouped into two listings, recommended and non-recommended, each arranged in order of descending SIR. These lists may be subdivided by building or area as appropriate for the study. The AE shall submit the Scope of Work and any modifications to the Scope of Work as an appendix to the report. A narrative summary describing the work and results to date shall be a part of this submittal. At the Interim Submittal and Review Conference, the Government's and AE's representatives shall coordinate with the Director of Public Works to provide the AE with direction for packaging or combining ECOs for programming purposes and also indicate the fiscal year for which the programming or implementation documentation shall be prepared. The survey forms completed during this audit shall be submitted with this report. The survey forms only may be submitted in final form with this submittal. They should be clearly marked at the time of submission that they are to be retained. They shall be bound in a standard three-ring binder which will allow repeated disassembly and reassembly of the material contained within.
- 7.6.2 Final Submittal. The AE shall prepare and submit the final report when all sections of the report are 100% complete and all comments from the interim submittal have been resolved. The AE shall submit the Scope of Work for the study and any modifications to the Scope of Work as an appendix to the submittal. The report shall contain a narrative summary of conclusions and recommendations, together with all raw and supporting data, methods used, and sources of information. The report shall integrate all aspects of the study. The recommended projects, as determined in accordance with paragraph 5, shall be presented in order of priority by SIR. The lists of ECOs specified in paragraph [7.6.1] shall also be included for continuity. The final report and all appendices shall be bound in standard three-ring binders which will allow repeated disassembly and reassembly. The final report shall be arranged

### to include:

- a. An Executive Summary to give a brief overview of what was accomplished and the results of this study using graphs, tables and charts as much as possible (See Annex B for minimum requirements).
- b. The narrative report describing the problem to be studied, the approach to be used, and the results of this study.
- c. Documentation for the recommended projects (includes LCCA Summary Sheets).
  - d. Appendices to include as a minimum:
    - 1) Energy cost development and backup data
    - 2) Detailed calculations
    - Cost estimates
    - 4) Computer printouts (where applicable)
    - 5) Scope of Work

#### ANNEX A

# DETAILED SCOPE OF WORK

### 1. LOCATION

a. <u>GENERAL DESCRIPTION</u>. The Architect Engineer (AE) shall furnish all services, materials, supplies, labor, equipment, investigations, studies, and travel as required in connection with the feasibility study for the below identified project in accordance with the contract and all furnished instructions:

INSTALLATION

DESCRIPTION Fort Leonard Wood, Missouri Providing Thermal Storage at Central Chilled Water Plant

- b. The project consists of studying the feasibility of providing thermal at the central chilled water plant, building 745, to reduce electric peak demand charges. The Plant now has two chillers providing water to the 600 area. There are plans to expand this system to the 700 area. This will require adding more chillers, either expanding the plant or converting the space currently occupied by 5 boilers to new chillers. This study will determine if it is ecconomically feasible to provide thermal storage to reduce the electrical demand.
- 2. <u>AUTHORIZATION</u>. The feasibility study for this project is authorized by Memorandum CEMP-ET, Subject: Energy Engineering Analysis Program (EEAP)-FY94 dated 7 December 1993. The AE shall make reference to this authority in the study.
- Design Manuals, Ιf the STUDY INSTRUCTIONS. Specifications, and/or Project Engineering Instructions do not cover a specific condition in question, the AE shall contact the Contracting Officer before proceeding. If there is a conflict in Engineering Instructions or other reference data, such questions or conflicts should be brought to the attention of the Contracting Officer before proceeding.
- THE INSTALLATION REPRESENTATIVE for this contract will be Mr. Douglas Cage, Directorate of Public Works, telephone number 314-596-0940, fax number 314-596-0170. The Kansas City Project Manager will be Mr. Robert Miller, telephone number 816-426-7348, fax number 816-426-3690. The Authorized Representative of the Contracting Officer will be Mr. Michael Whitacre, telephone number 816-426-2781, fax number 816-426-3690...
- COMPLETION AND PAYMENT SCHEDULE: The following schedule be used as a guide in approving payments on this contract. The interim report for shall be due not later than 180

days after Notice to Proceed. The prefinal report shall be due not later than 30 days after the interim report review conference. The final report shall be due not later than 21 days after the prefinal review conference.

PERCENT OF CONTRACT

AMOUNT

MILESTONE

AUTHORIZED FOR PAYMENT

Entry Interview 10
Completion of Field Work 25
Receipt of Interim Submittal 75
Completion of Interim Presentation & Review 85

### 6. METHOD OF PAYMENT.

- a. Title I. The AE shall prepare and submit to the US Army Engineer District, Kansas City, partial payment estimates in accordance with the attachment entitled "Instructions for Completion of ENG Form 93." All partial payments shall be based on work completed as of the 15th day of the report month and shall be submitted to the office of the Contracting Officer by the 18th day of the month. Payment under this contract, for which property or services are provided in a series of partial executions or deliveries, will be made within 30 days after receipt of an invoice which has been properly executed by the AE.
- b. Additional Conferences. Payment for furnishing the services of technically qualified representatives to attend additional conferences, when so requested in writing by the Contracting Officer, will be made at a rate per hour for the discipline involved plus travel expenses computed in accordance with Government Joint Travel Regulations in effect at the time travel is performed and actual cost of transportation.
- 7. THE SIMULATION PROGRAMS acceptable for use in this study are listed below. Any substitutes must be submitted and approved as outlined in the basic scope of work.
  - a. Building Loads and System Thermodynamics (BLAST)
  - b. DOE 2.1B
  - c. Carrier E20 or Hourly Analysis Program (HAP)
  - d. Trane Air-Conditioning Economics (TRACE)
  - e. Beacon

8. A COMPUTER PROGRAM titled Life Cycle Costing in Design (LCCID) is available from the BLAST Support Office in Urbana, Illinois for a nominal fee. This computer program can be used for performing the economic calculations for ECIP and non-ECIP ECOs. The AE is encouraged to obtain and use this computer program. The BLAST Support Office can be contacted at 144 Mechanical Engineering Building, 1206 West Green Street, Urbana, Illinois 61801. Telephone number is (217) 333-3977 or (800) 842-5278.

## 9. FACILITY SURVEY

The Architect-Engineer (AE) shall conduct a survey of the boiler plant and buildings to be supplied by the summer boiler.

# 10. AUTOMATED REVIEW MANAGEMENT SYSTEM (ARMS).

- a. The AE, as a part of this scope of work, shall interface with and utilize the Corps of Engineers Automated Review Management System for this project. The AE will receive one copy of CESPK-PAM 1110-1-2, AE Response Package (User's Manual) describing the communications software, optimum hardware requirements and access procedures. The necessary software is included with the manual. Minimum requirements are an IBM-XT or compatible computer system running DOS 3.0 or later, with 640 kilobyte (KB) RAM, at least a 20 megabyte (MB) hard disk and a 1200 or higher baud Hayes-compatible modem operating. Assistance can be received via a telephone hotline at 916-551-3126.
- b. All design review comments and responses will be electronically transmitted from the Corps of Engineer, Missouri River Division, by the ARMS. Comments can be received at a personal computer in the AE's office by use of ARMS software and a modem over telephone lines. The comments reside on the Missouri River Division computer. The AE can then download the review comments, respond to the comments, upload the comments back to the Division computer and forward responses to the Project Manager.

# 11. GOVERNMENT-FURNISHED DATA.

- a. AR 415-15 Military Construction, Army (MCA) Program Development
  - b. AR 415-20 Project Development and Design Approval
  - d. Engineering Instructions (as applicable)
  - e. Latest Tri-Service Cost Index.

f. DAIM-FDF-U letter dated 10 January 1994, "Energy Conservation Investment Program (ECIP) Guidance".

# 12. SUBMITTAL REQUIREMENTS.

ORGANIZATION	COPIES REQU (Correspondence);	JIRED Interim & Prefinal Review	(Final)
Commander Engineer Center & FSort Leonard Wood ATTN: ATZT-DPW-E0/Mr. ( Building 2104 Granite City, Illinois 62040-1801	(1) Cage	3***	(3)
District Engineer U.S. Army Engineer Dis ATTN: CEMRKED-MF(MILLE) 700 Federal Building Kansas City, Missouri 64106	trict, Kansas City	3***	(3)
Division Engineer U.S.Army Engineer Divi Missouri River ATTN: CEMRDMP-A(Jagasi 12565 W. Center Road Omaha, NE 68144-3869		3***	(1)
Commander H.Q. TRADOC ATTEN: ATEN-EN/ Mr. Ca Building 10 Fort Monroe, Va. 23351		1,	(1)
HQDA ODCSLOG ATTN: DALO-TSE (Maj. W Pentagon Washington, D.C. 20310			(1)*
Commander U.S. Army Corps of Englants ATTN: CEMP-ET (Mr. Ger 20 Massachusetts Avenu Washington, DC 20314-1	ntil) ie, NW	1*	(1)*

Commander (1) 1 (1)
U.S. Army Engineer District, Mobile
ATTN: CESAM-EN-CM (Mr. Battaglia)
P.O. Box 2288
Mobile, AL 36628-1000
Commander (1)\*

Commander
U.S Army Logistics Evaluation Agency
ATTN: LOEA-PL (Mr. Keath)
New Cumberland Army Depot
New Cunberland, PA. 17070-5007

- \* Executive Summary only
- \*\* Complete copy of final report
- \*\*\* Furnish copy of computer print out

### ANNEX B

# EXECUTIVE SUMMARY GUIDELINE

- 1. Introduction.
- Building Data (types, number of similar buildings, sizes, etc.)
- 3. Present Energy Consumption of Buildings or Systems Studied.
  - o Total Annual Energy Used.
  - o Source Energy Consumption.

Electricity - KWH, Dollars, BTU
Fuel Oil - GALS, Dollars, BTU
Natural Gas - THERMS, Dollars, BTU
Propane - GALS, Dollars, BTU
Other - QTY, Dollars, BTU

- Reevaluated Projects Results.
- Energy Conservation Analysis.
  - o ECOs Investigated.
  - o ECOs Recommended.
  - o ECOs Rejected. (Provide economics or reasons)
  - o ECIP Projects Developed. (Provide list)\*
  - o Non-ECIP Projects Developed. (Provide list)\*
  - o Operational or Policy Change Recommendations.
- \* Include the following data from the life cycle cost analysis summary sheet: the cost (construction plus SIOH), the annual energy savings (type and amount), the annual dollar savings, the SIR, the simple payback period and the analysis date.
- Energy and Cost Savings.
  - o Total Potential Energy and Cost Savings.
  - o Percentage of Energy Conserved.

o Energy Use and Cost Before and After the Energy Conservation Opportunities are Implemented.

#### ANNEX C

## REQUIRED DD FORM 1391 DATA

To facilitate ECIP project approval, the following supplemental data shall be provided:

- a. In title block clearly identify projects as "ECIP."
- b. Complete description of each item of work to be accomplished including quantity, square footage, etc.
- c. A comprehensive list of buildings, zones, or areas including building numbers, square foot floor area, designated temporary or permanent, and usage (administration, patient treatment, etc.).
- d. List references, and assumptions, and provide calculations to support dollar and energy savings, and indicate any added costs.
- (1) If a specific building, zone, or area is used for sample calculations, identify building, zone or area, category, orientation, square footage, floor area, window and wall area for each exposure.
  - (2) Identify weather data source.
- (3) Identify infiltration assumptions before and after improvements.
- (4) Include source of expertise and demonstrate savings claimed. Identify any special or critical environmental conditions such as pressure relationships, exhaust or outside air quantities, temperatures, humidity, etc.
- e. Claims for boiler efficiency improvements must identify data to support present properly adjusted boiler operation and future expected efficiency. If full replacement of boilers is indicated, explain rejection of alternatives such as replace burners, nonfunctioning controls, etc. Assessment of the complete existing installation is required to make accurate determinations of required retrofit actions.
- f. Lighting retrofit projects must identify number and type of fixtures, and wattage of each fixture being deleted and installed. New lighting shall be only of the level to meet current criteria. Lamp changes in existing fixtures is not considered an ECIP type project.

- g. An ECIP life cycle cost analysis summary sheet as shown in the ECIP Guidance shall be provided for the complete project and for each discrete part included in the project. The SIR is applicable to all segments of the project. Supporting documentation consisting of basic engineering and economic calculations showing how savings were determined shall be included.
- h. The DD Form 1391 face sheet shall include, for the complete project, the annual dollar and MBTU savings, SIR, simple amortization period and a statement attesting that all buildings and retrofit actions will be in active use throughout the amortization period.
- i. The calendar year in which the cost was calculated shall be clearly shown on the DD Form 1391.
- j. For each temporary building included in a project, separate documentation is required showing (1) a minimum 10-year continuing need, based on the installation's annual real property utilization survey, for active building retention after retrofit, (2) the specific retrofit action applicable and (3) an economic analysis supporting the specific retrofit.
- k. Nonappropriated funded facilities will not be included in an ECIP project without an accompanying statement certifying that utility costs are not reimbursable.
- 1. Any requirements required by ECIP guidance dated 25 April 1988 and any revisions thereto. Note that unescalated costs/savings are to be used in the economic analyses.
- m. The five digit category number for all ECIP projects except for Family Housing is 80000. The category code number for Family Housing projects is 71100.

### APPENDIX B

### DETAILED SYSTEM SIZING PROCEDURES AND CALCULATIONS

### **B.1 ICE HARVESTING SYSTEMS**

Appendix C contains manufacturer's literature for a typical ice harvesting type of system. Five alternative systems were evaluated, utilizing various combinations of run times vs. off times, and in addition varying the amount of time the systems ran making ice to the amount of time they ran as conventional chillers. The five systems analyzed are summarized in the following table.

ECO#	HOURS MAKING ICE	HOURS AS CHILLER	HOURS "OFF"
IH-1	8	16	0
IH-2	8	10	6
IH-3	12	12	0
IH-4	. 12	6	6
IH-5	8	13	3

As indicated in a previous section, the ice harvesting system has the ability to continue to produce chilled water during the hours it is in the ice-making mode, due to the fact that the generated ice is de-coupled from the ice-making apparatus. It is therefore available as a separate chilling source. Therefore, the columns labeled as "hours making ice" should not be interpreted as though chilled water cannot be produced during those hours. It simply means that the mechanical refrigeration system will be making ice during those periods.

Each of the indicated ECO's is discussed in the following sections.

### B.1.1 ECO IH-1

In this analysis, the system was allowed to build ice during the eight hours of 1:00 a.m. through 9 a.m. inclusive. During the remaining sixteen hours of the day, the plant was allowed to operate as a normal chiller. Applying those parameters to the June to September load profile for Area 600, it was found that an ice storage capacity of 2200 ton-hours coupled with a nominal chiller tonnage of 630 tons (485 tons when making ice) would meet all load conditions and would never totally deplete the tank ice capacity. See Appendix D for the load and demand profile printouts. This results in a relatively low first cost compared to the other alternatives. However, since the refrigeration plant is never "off," demand charges are not avoided, which is the major thrust of the project.

### B.1.2 ECO IH-2

In an effort to address the demand changes incurred under ECO IH-1, ECO IH-2 turned the chiller "off" during the mid-afternoon period from noon through 6:00 p.m. All other operational hours remained unchanged from ECO IH-1.

The results of this approach was to drive up significantly the required ice-making capacity of the plant, since stored ice would be all that would be available to carry load during the chiller "off" period. The nominal chiller capacity rose to 1,150 tons (885 tons of ice-making capacity), and ice storage volume of 5,000 ton-hours. Load and demand profiles are contained in Appendix D.

### B.1.3 ECO IH-3

This ECO was another variation of ECO IH-1. It was suggested that it might be possible that, in exchange for a longer ice-build time, the size of the chiller needed to supplement the stored ice during the peak afternoon hours might be reduced to the point that the incurred demand charges associated with the chiller might be more economically bearable.

As a result, the ice-build time was expanded to 12 hours, running from 9:00 p.m. through 9:00 a.m. inclusive. From 9:00 a.m. until 9:00 p.m., the system was used to generate chilled water. The resulting load and demand profiles are contained in Appendix D. While extension of the ice build time did result in a smaller chiller requirement, the reduction in size from ECO IH-1 was very slight, from 630 tons to 625 (or from 485 tons of ice-making capacity to 480). As might be expected, the required ice storage capacity increased slightly from 2,200 ton-hours under ECO IH-1 to 2,400 ton-hours under ECO IH-3.

### B.1.4 ECO IH-4

This ECO was a modification of ECO IH-3, using the same ice-making hours, but again turning the chiller plant "off" from noon through 6:00 p.m., to avoid demand charges, as was done under ECO IH-2.

The results of this approach were encouraging. Requiring the stored ice to carry the total load during the six afternoon hours drove the ice-making tonnage up from 480 to 750 tons, but the allowance of 12 hours for making ice meant that the 750 tons of capacity was considerably less than the 885 tons that had been required under ECO IH-2. At the same time, the storage capacity required under this ECO was found to be 5,000 ton-hours, which is the same as that required under ECO IH-2.

Again, cooling load and demand profiles for this ECO are contained in Appendix D.

### B.1.5 ECO IH-5

A close analysis of the electrical demand profile curve obtained from the electric utility company, referred to in Section 3, indicates that there may be a window of demand establishment as narrow as three hours (from 1:00 p.m. to 4:00 p.m.) during which time an imposition of any additional large refrigeration plant loads on a design day would definitely result in establishment of a new demand peak. Conversely, it appears that the demand loads outside of this hour range fall off steeply enough that powering of the refrigeration plant would not result in establishment of a new demand peak.

Under this hypothesis, an analysis similar to ECO IH-2 was developed, but one in which the chiller was off only from 1:00 p.m. to 4:00 p.m. It was used to build ice between 1:00 a.m. and 9:00 a.m., and would be used as a chiller during the remainder of the day. The results of this approach appeared to be quite promising. The required chiller capacity was reduced to 820 tons from the 1,150 tons needed under ECO IH-2, and the thermal storage capacity was reduced from 5,000 ton-hours to 2,600 ton-hours.

Of course, the value of these numbers is dependant upon the validity of the hypothesis stated above. This approach results is a "fine-tuned" solution to a narrow period of peak demand. The resulting cooling and peak demand load profiles are in Appendix D.

### **B.2 ICE TANK SYSTEMS**

Appendix C contains manufacturer's literature for a typical ice tank type of system. As with the ice harvesting systems, a total of five alternative systems were evaluated with different mixes of chilling, ice-building, and off hours over a 24-hour period. The following table summarizes these combinations:

	HOURS	HOURS AS	
ECO#	MAKING ICE	CHILLER	HOURS "OFF"
IT-1	8	16	0
IT-2	11	13	0
IT-3	8	10	6
IT-4	11	7	6
IT-5	11	10	3

Each of the indicated ECO's is discussed in the following sections.

### B.2.1 ECO IT-1

In this first analysis, the ice tank was charged during the period from 1:00 a.m. through 9:00 a.m., and was drawn down (supplemented by the refrigeration equipment producing chilled water) during the other hours of the day. There was no period when all

equipment was "off." A supplemental chiller was used at night to provide cooling to the Barracks buildings while the main system was building ice.

This scenario resulted in the need for an ice-making capacity of 375 tons (approximately 500 chiller tons) coupled to an ice-tank with a thermal storage capacity of 3,300 ton-hours. In addition, a night chiller with a 400 ton cooling capacity would also be required. While this results in a relatively small total chiller capacity, it is noted that in this option, as in ECO IH-1, there is never an "off" period for the cooling plant, so demand charges are never truly avoided.

Appendix D contains the ice plant loading and demand profiles for the cooling months. It should be noted that this printout does not include the load/demand met by the separate night chiller, since this is independent of the thermal storage plant. Energy usage of the night chiller system is accounted for in energy printouts which are contained in Appendix E. This is true for all of the ice tank system alternatives analyzed.

### B.2.2 ECO IT-2

ECO IT-2 was developed as a means of reducing the size of the chiller which would need to run during the afternoon hours by having more supplemental ice available by lengthening the ice build time. Therefore, the ice build time period was extended to run from 11:00 p.m. until 10:00 a.m., a total of 11 hours, with the chiller generating chilled water the rest of the time.

As with ECO IH-3, where the same approach was tried, there was some benefit in demand reduction, but not a large one. The chiller tonnage dropped from 500 tons to 450 tons compared to ECO IT-1, which is an ice-making tonnage reduction from 375 tons to 345 tons. However, the ice tank thermal storage volume rose from 3,300 ton-hours to 4,000 ton-hours. Also, the size of the night chiller required rose from 400 tons to 450 tons. See Appendix D for the summer load and demand profiles.

### B.2.3 ECO IT-3

This scenario uses the hours from 1:00 a.m. to 9:00 a.m. for ice building and turns all mechanical equipment (except chilled water pumps) off from 12 noon until 6:00 p.m. to avoid adding to peak demands established during that period. During other hours, the refrigeration equipment runs as a conventional chiller.

The requirements for stored ice to serve as the sole means of carrying load over a six-hour period drove up both the size of the thermal storage tank (to 6000 ton-hours) and the ice-making capacity of the refrigeration plant, to 625 tons (approx. 810 tons of normal chilling capacity). Since the ice-build time was reduced to the same 8 hour period used in ECO IT-1, however, the night chiller's capacity returned to 400 tons, as was the case in ECO IT-1. Appendix D contains the summer load and demand profiles for this case.

### B.2.4 ECO IT-4

This alternative assumed that ice will be built over an 11 hour period from 11:00 p.m. until 10:00 a.m., that all systems except chilled water pumps will be off during the period from 12 noon until 6:00 p.m. to avoid demand charges, and that the refrigeration plant will operate as a chiller during all other periods.

The effect of extending the ice build time by 3 hours compared to ECO IT-2 is to reduce the required size of the ice-making capacity of the refrigeration plant since it has a longer time available over which to build the required ice. As a result, the capacity requirement dropped to 490 tons (635 tons chilling capacity) compared to the 625 tons (810 tons chilling) of ice-making capacity required in ECO IT-3. The size of the storage tank remained at 6,000 ton-hours, however. Also, the size of the night chiller required to serve the Barracks buildings increased to 450 tons. Load and demand profiles are presented in Appendix D.

### B.2.5 ECO IT-5

As with ECO IH-5, this ECO narrowed the peak demand window to three hours from 1:00 p.m. until 4:00 p.m. Also as with ECO IH-5, the result was a significant improvement over use of a six hour "off" period for the refrigeration plant. The required ice-making tonnage dropped to 400 tons (520 tons chilling capacity) and required total thermal storage was reduced to 4,500 ton-hours. The same caution applies here that was stated in the ECO IH-5 discussion. The results are only valid if total Fort demand is low enough prior to 1:00 p.m. and after 4:00 p.m. See Appendix D for cooling load and demand profiles for this ECO.

### B.3 BASE CASE

As stated earlier, a conventional mid-range efficiency centrifugal chiller was used as the base case against which the various ECO's would be compared. The peak load calculated for Area 600 resulted in selection of a chiller with a nominal capacity of 900 tons. Manufacturer's literature for such a typical chiller is included in Appendix C.

### **B.4 SUMMARY OF CALCUALTIONS**

The following table summarizes the data presented in the preceding paragraphs, upon which energy calculations were based:

ECO#	REQUIRED ICE- MAKING TONS	EQUIVALENT CHILLER TONS	REQUIRED NIGHT CHILLER CAPACITY	REQUIRED TON-HOURS THERMAL STORAGE
IH-1	485	630	~~	2,200
IH-2	885	1,150		5,000
IH-3	480	625		2,400
IH-4	750	975		5,000
IH-5	630	820		2,600
IT-1	375	490	400	3,300
IT-2	345	450	450	4,000
IT-3	625	815	400	6,000
IT-4	490	635	450	6,000
IT-5	400	520	450	4,500
BASE		900		

### APPENDIX C

### MANUFACTURER'S LITERATURE

<u>ITEM</u>	<b>PAGE</b>
TYPICAL ICE HARVESTER EQUIPMENT	C-1 TO C-4
TYPICAL ICE TANKS	C-5 TO C-7
SCREW CHILLER (FOR ICE TANK SYSTEM)	C-8
CENTRIFUGAL CHILLER (NIGHT CHILLER)	C-9
COOLING TOWER (ALL SYSTEMS)	C-10

# Only Turbo Ice Harvesting gives you the flexibility for operating as many hours as you want.

# Turbo: A leadership company in a corporate family of Industry leaders.

Turbo Refrigerating Company was founded in 1952 to provide specialized ice making and industrial refrigeration systems.

Turbo pioneered itself as the leading world supplier of this technology, having built over 70% of the industrial ice harvesting capacity for consumer packaged ice.

Today Turbo is the world leader in ice harvesting Thermal Storage Systems and industrial chillers.

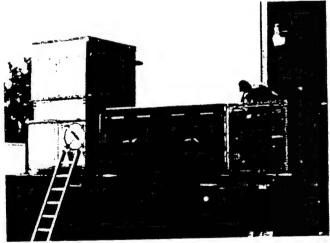
Turbo is a member of the Aqua-Chem family of companies – each a recognized leader in its specialized field:

**Cleaver-Brooks** – Originator and largest producer of packaged boilers for industrial, commercial, and institutional use.

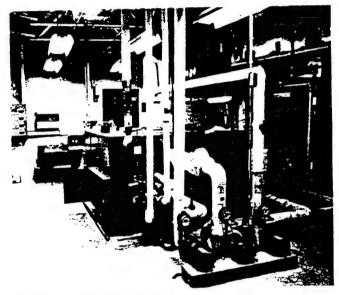
**Water Technologies Division** – World leader in water evaporative and desalination equipment for chemical processing and marine application.

Industrial Combustion – Foremost manufacturer of multi-fuel conversion burners for new and retrofit industrial and commercial applications.

Aqua-Chem companies are deeply involved in energy and water technologies, and are committed to continuing advancements in product efficiency and reliability.



HP300SCE – A fully self-contained ice generator chiller with an evaporative condenser system



HP100SC – A fully self-contained ice generator chiller with a water cooled condenser system.

Unlike other thermal storage systems, the Turbo ice harvesting design uses an ice-making surface that is completely separate from the ice storage tank. The ice-making surface consists of stainless steel plates that are welded together to form computer-designed internal channels for controlled flow of refrigerant. Water is distributed uniformly over the outside of the plates. The plates are grouped vertically in modules directly above the ice storage tank. Ice forms on both sides in sheets 1/4 inch thick. Then, at predetermined intervals, hot refrigerant enters the plates, causing the ice to break away and drop into the tank. The ice breaks into small pieces in the tank.

The cycle is repeated as long as there is need for additional cooling reserves. Turbo ice gives a tremendous amount of heat transfer area, allowing very rapid melting with no risk of short circuiting of the return chilled water.

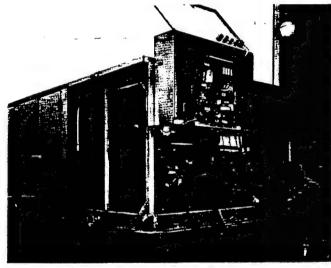
This continuous ice making capability is impossible with systems where heat transfer coils are submerged in ice storage tanks – because the ice making surfaces become encased in ice, insulating the heat transfer surface and reducing the efficiency of the system, while waiting for a thaw before production can resume.

Nothing could be simpler than inspecting, cleaning or servicing Turbo heat transfer plates. They're always accessible – because they're completely separated from ice storage. Open the front or rear panel of the ice maker cabinet – and there they are!

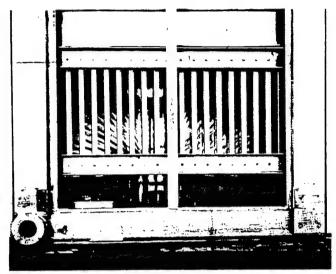
### All operating components, controls easily accessible.

Talk about convenience! Electrical controls, compressor, condenser—all maintenance components are located for easy access that simplifies inspection and servicing.

Only Turbo supplies complete single-source systems: packaged or modular, standard or custom.



HP1000SCER – The compressor compartment showing the ease of accessibility.



The evaporator plate assembly.

## Large units can be factory-assembled, tested before delivery.

Only Turbo meets your requirements totally and precisely, whatever the level of need. Which means you don't pay for too much compressor, too much capacity or too much storage for your system needs. Turbo delivers a system of fully compatible components, engineered for maximum cost effectiveness. An advantage that covers thermal storage capacities much larger than available with alternative approaches.

The standard Turbo package is a self-contained or split unitary system. Ice-making plates, refrigerant piping, condensers and controls are provided in a proven reliable package.

### Options Available:

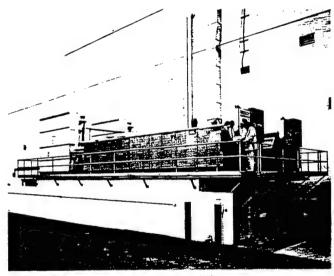
- Choice of air-cooled, water-cooled or evaporatively cooled condensers
- Desuperheaters and controls for heat recovery
- Electrical panel for remote stand-alone installations.
- · Recirculation pump package
- Ice-storage-tank prefabricated or custom designed, field erected

### HP Series Packages – to 95 tons

Proven design. Available as self-contained package without field refrigerant piping. Shippable by standard truck with no special permits required. Available in water cooled (SC), evaporatively cooled (SCE), or air cooled models (SCA).

### IGC Series Packages - 55 to 300 tons

Proven design. Available as self-contained package without field refrigerant piping. Shippable by standard trucks. Available in water cooled (SC), evaporatively cooled (SCE), or air cooled (SCA) models.



HP1000SCE - Two units with two 4000 cubic foot Turbo insulated steel storage tanks.

### **Standard Split System Packages**

Remote condenser models available for air cooled or evaporatively cooled systems. In both the HP and IGC SERIES. (SC R).

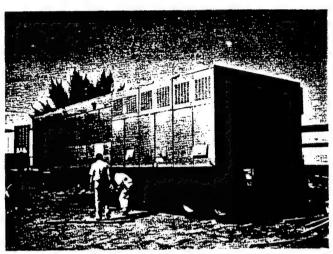
Remote condensing unit models available for connection to existing or Turbo condensing units. (R)

### To 300 tons

Larger systems require separate plate, compressor and condenser modules. Plate modules available to 300 tons capacity per module. Modules bolt together in the field, and require minimum field refrigerant piping.

### **Custom Engineered Systems**

Our engineers will work closely with you to meet special needs for larger or unique applications using standard modules

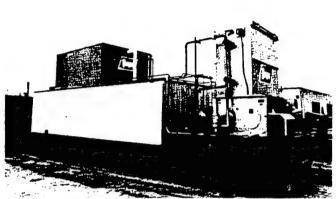


IGC245SC – A fully self-contained water cooled-ice generator chiller unit.



IGC245SC – Control panels

# Economic technications Dynamic economic technical The Constant Form



HP200SCE – A complete packaged system with an HP200SCE, evaporative condenser and insulated steel storage tank.

EQUIPMENT SCHEDUL	E: MODEL (HP	,)	(IGC	)
Operating Mode	Water onto plates (F)		sct (F)	motor BHP
Ice Generation				
Super Chiller				

### **EQUIPMENT:**

The ice making equipment shall be a completely factory assembled unit of the harvesting type provided by TURBO REFRIGERATING COMPANY. The equipment shall have the following features.

### **Evaporater sections**

The evaporater section shall utilize vertical evaporater plates made of 304 stainless steel

### Water distribution

The equipment shall have a stainless steel water distribution pan and be provided with all water distribution piging

#### Frames

The frames (HP) shall be fully welded and not dip galvanized after fabrication.

The frames (IGC) shall be fully welded and coated with a rust preventative primer and water proof finish

### Cabinets

The cabinets shall be insulated with 2" of foam urethane and suitable for outdoor application. The outer panels shall be protected with an approved exterior finish.

### Compressor

The compressor shall be of the open (semi-hermetic) reciprocating type complete with motor and starter, or screw compressor with motor or starter.

#### Condensers

The condenser shall be of the evaporative type, (water cooled), (air cooled).

### Refrigerant piping

The refrigerant piping shall utilize direct expansion vaives, hot gas harvesting valves and a suction line accumulator with integral liquid suction interchanger, receiver designed to hold entire refrigerant charge. All vessels shall be constructed in accordance with the ASME Pressure Vessel Code.

### Controls

Controls shall be electric or electronic and include allice harvesting controls, water level controls, and refrigeration controls.

#### TESTING:

All system components are operationally checked before shipping.

Full factory run tests are available upon request



TURBO REFRIGERATING COMPANY

PO BOX 396 DENTON TX 7620; 817-367-4301 TELEX 687 1006 TURBO - IX EAX 817-367-0364

# A new application of an old idea that can cut air conditioning energy costs in half.

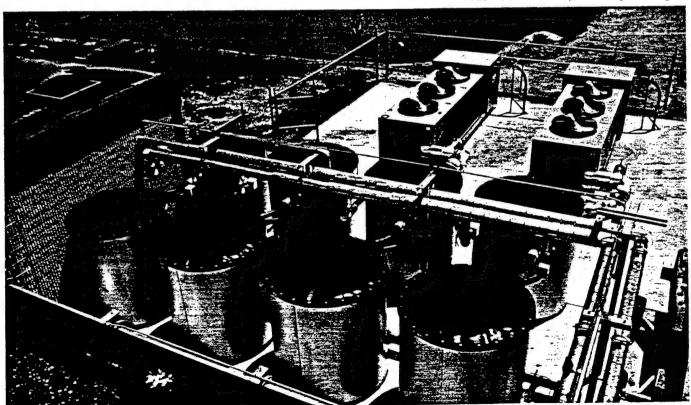
Air conditioning during summer daytime hours is the largest single contributor to utility "peak demand" charges. After noon, as more air conditioners are needed to maintain comfortable temperatures, the increased demand for electricity adds to that already created by lighting, operating equipment, computers and thousands of other uses. This requires the utility to bring additional, more costly generating sources on line to handle its increased demand. Commercial users whose large air conditioning loads contribute to these added generating requirements are assessed an additional charge based on their highest on-peak demand for electricity.

An Ice Bank Stored Cooling System is either a load-shifting or load-leveling method which will significantly lower demand charges during the air conditioning season and, consequently, energy costs. It uses a standard packaged chiller to produce solid ice at night during off-peak periods when the building's electrical needs are at a minimum. The ice is built and stored in modular ice tanks to provide cooling to help meet the building's air conditioning load requirement the following day.

Making ice at night and using its stored energy during the day is not a new or experimental idea. This concept had been employed for years in cooling short-peak applications such as churches and theatres. However, longer peak uses were served by air-source rooftop and chiller-type air conditioners which were less costly to install. Now there is renewed interest in a broad use of ice-making systems by both users and utilities as the best way to offset rising operating costs. In fact, Stored Cooling Systems are what summerpeaking utilities must have to avoid the unbearable costs of new generating plants.

lce Banks not only can cut operating costs in half but they can also substantially reduce capital outlays when systems are suitably designed for new commercial and industrial buildings. Engineers can specify half-size chillers operating 24 hours a day rather than full-size chillers operating only 10 or 12 hours per day. In retrofit applications, an Ice Bank Stored Cooling System can often provide cooling for an addition to a building without adding chiller capacity.

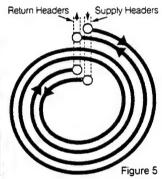


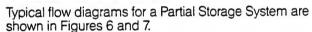


## How the LEVLOAD System Works

The LEVLOAD Ice Bank is a modular, insulated polyethylene tank containing a spiral-wound plastic tube heat exchanger surrounded with water. They are available in four sizes – 90, 100, 190 and 570 ton-hours. At night, a 75 percent water-25 percent glycol solution from a standard packaged air conditioning chiller circulates through the heat exchanger and extracts heat until eventually all the water in the tank is frozen solid. The ice is built uniformly throughout the tank by the patented temperature-averaging effect of closely spaced counterflow heat exchanger tubes, Figure 5. Water does not become surrounded by ice during the freezing process and can move freely as ice forms, preventing stress or damage to the tank.





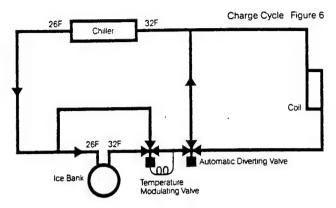


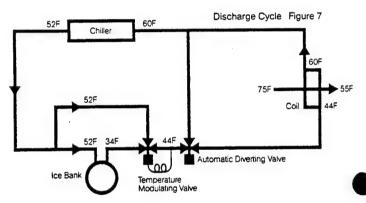
At night, the water-glycol solution circulates through the chiller and the Ice Bank heat exchanger, bypassing the air handler coil. The fluid is at 26F and freezes the water surrounding the heat exchanger.

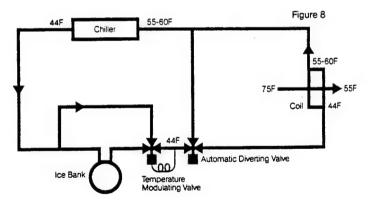
During the day, the solution is cooled by the Ice Bank from 52F to 34F. A temperature modulating valve set at 44F in a bypass loop around the Ice Bank permits a sufficient quantity of 52F fluid to bypass the Ice Bank, mix with the 34F fluid, and achieve the desired 44F temperature. The 44F fluid enters the coil, where it cools air from 75F to 55F. The fluid leaves the coil at 60F, enters the chiller and is cooled to 52F.

It should be noted that, while making ice at night, the chiller must cool the water-glycol solution to 26F, rather than produce 44 or 45F water temperatures required for conventional air conditioning systems. This has the effect of "derating" the nominal chiller capacity by approximately 30 percent. Compressor efficiency, however, is only slightly reduced because lower nighttime temperatures result in cooler condenser water from the cooling tower and help keep the unit operating efficiently. Similarly, air cooled chillers benefit from cooler condenser entering air temperatures at night.

The temperature modulating valve in the bypass loop has the added advantage of providing unlimited capacity control. During many mild temperature days in the spring and fall, the chiller will be capable of providing all the necessary cooling for the building without assistance from stored cooling. When the building's actual cooling load is equal to or lower than the chiller capacity, all of the system coolant flows through the bypass loop, as in Figure 8.







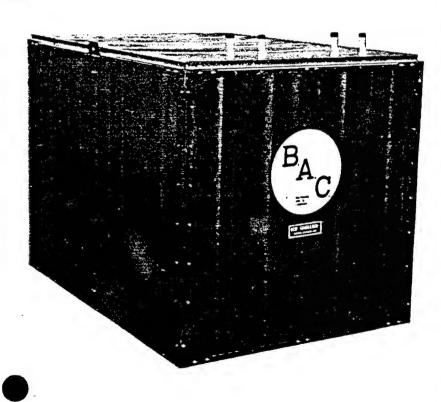
The glycol recommended for the solution is an ethylene glycol-based industrial coolant, such as Dow Chemical Company's Dowtherm® SR-1 or Union Carbide Corporation's UCARTHERM, which are specially formulated for low viscosity and superior heat transfer properties. These contain a multi-component corrosion inhibitor system which is effective with most materials of construction, including aluminum, copper, solder and plastics. Unlike automotivetype anti-freeze, they produce no films and contain no anti-leak agents to interfere with heat transfer efficiency and permit use of standard system pumps, seals and air handler coils. However, because of the slight difference in heat transfer coefficient between water-glycol and plain water, coil capacity should be increased by approximately 5 percent. It is also important that the water and glycol be thoroughly mixed before the solution enters the system.

### ETHYLENE SLYCOL

An industrially inhibited ethylene glycol solution specifically designed for HVAC applications must be used with the ICE CHILLER® Thermal Storage Unit. The 25% by weight ethylene glycol solution is designed to provide freeze/burst and corrosion protection. Corrosion inhibitors are provided to minimize system corrosion without fouling. Dowtherm® SR-1\* and UCARTHERM®\*\*\* are acceptable fluids.

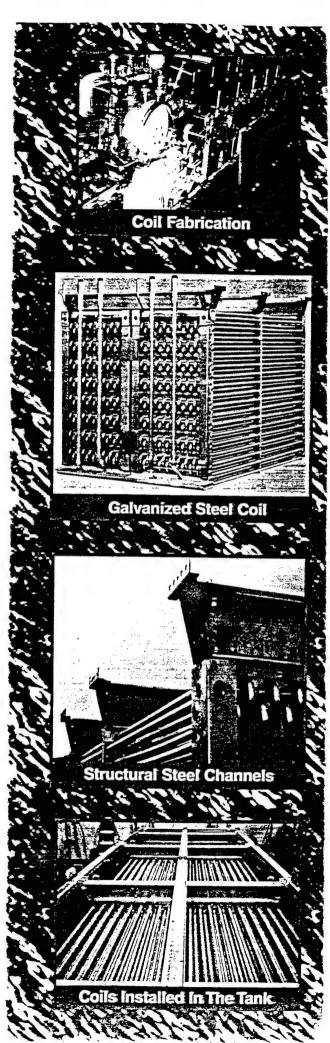
### MCBULAR CONSTRUCTION

The rectangular design of these units maximizes the ton-hours per square foot of available plan area. The product is designed specifically for tight installations where access is limited. The 7'-10" wide units are designed so that they can be installed through interior double-door openings. For applications where extreme access limitations exist, the tanks are available unassembled for field erection. Units can be installed either indoors or outdoors.



<sup>\*</sup> Dowtherm<sup>9</sup> is a registered trademark of Dow Chemical Company.

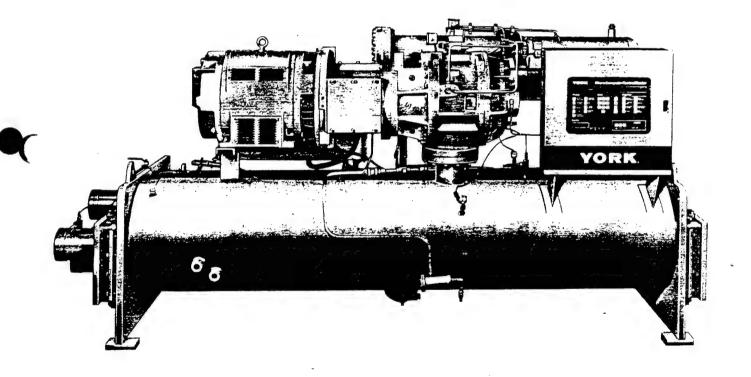
<sup>\*\*</sup> UCARTHERM\* is a registered trademark of Union Carbide Corporation, U.S.A.



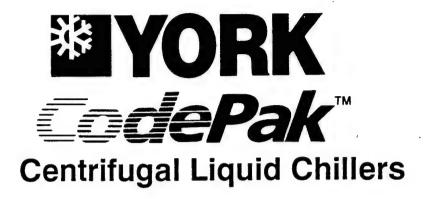
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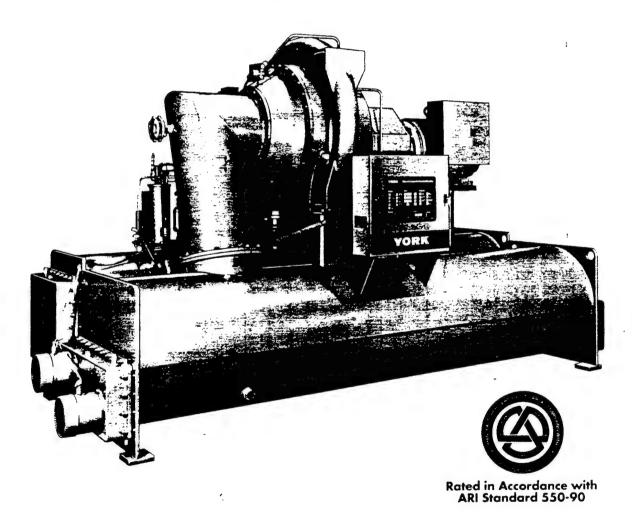
# CodePak <sup>™</sup>

# **Rotary Screw Liquid Chillers**



125 through 675 tons





MODEL YT 150 THROUGH 1000 TONS

**FULLY COMPATIBLE WITH R-11 AND R-123** 

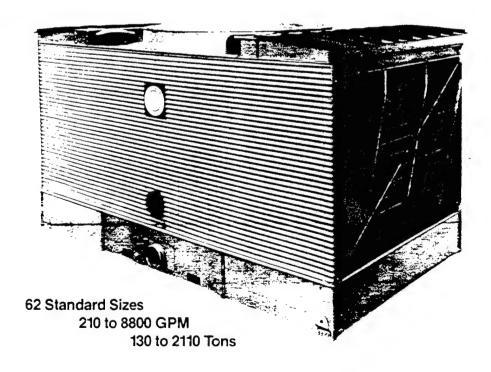


**Baltimore Aircoil** 

MORE SIZES MORE FEATURES

# Series 3000 INDUSTRIAL **COOLING TOWERS**

Thermal Performance Certified by the Cooling Tower Institute



- Featuring: The New EASY CONNECT™ Piping Arrangement
  - The BALANCE CLEAN™ Chamber
  - Fiberglass-Reinforced Polyester casing and louvers

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### APPENDIX D

# COOLING LOAD AND DEMAND PROFILE COMPUTER PRINTOUTS

# ECO IH-1

---- PUILDING COOLING DEMANDS AND THERMAL STORAGE----

June

			Design							
	Desi	ign	Cooling	Chiller	Chiller	Storage				
	DADB	DANB	Load	Load	Demand	Capacity				
Hour	{F}	(F)	(Ton)	(Ton)	(kW)	(Ton-Hr)				
1	68.7	65.1	0.0	0.0	0.0	2,200				
2	67.8	54.4	0.0	0.0	0.0	2,200				
3	67.0	63.5	0.0	0.0	0.0	2,200				
4	60.4	62.7	0.0	0.0	0.0	2,200				
5	66.3	62.7	0.0	0.0	0.0	2,200				
b	66.6	63.7	0.0	0.0	0.0	2,200				
7	67.6	64.5	0.0	0.0	0.0	2,200				
8	69.3	65.1	0.0	0.0	0.0	2,200				
9	71.8	66.0	65.3	65.3	81.7	2,200				
10	74.5	67.6	109.2	109.2	101.0	2,200				
11	77.8	69.8	241.8	241.8	167.7	2,200				
12	80.9	71.9	384.5	384.5	255.8	2,200				
13	83.2	73.5	353.7	353.7	240.5	2,200				
14	84.7	74.4	435.0	435.0	296.8	2,200				
15	85.3	74.6	542.1	542.1	380.6	2,200				
16	84.7	74.5	682.4	630.0	456.8	2,148				
17	83.4	73.5	806.8	630.0	453.0	1,971				
18	81.3	71.5	769.0	630.0	445.6	1,833				
19	78.8	70.1	652.3	630.0	440.5	1,811				
20	76.3	70.0	591.1	591.1	406.5	1,811				
21	74.2	69.5	546.4	546.4	367.8	1,811				
22	72.3	68.7	422.4	422.4	272.9	1,811				
23	70.8	67.1	246.2	246.2	164.9	1,811				
24	69.7	65.8	170.5	170.5	125.9	1,811				

						Saturday				
	Ty	pical	Cooling Chiller Chiller		Storage	Cooling	Chiller	Chiller	Storage	
	DADB	DAME	Load	Load	Demand	Capacity	Load	Load	Demand	Capacity
Hour	(F)	(F)	(Ton)	(Ten)	(kH)	(Ton-Hr)	(Ion)	(Ton)	(比較)	(Ton-Hr)
1	67.6	65.3	119.5	485.0	454.0	2,175	125.9	211.4	192.1	2,200
2	66.0	63.9	103.2	130.3	133.7	2,200	102.7	102.7	94.1	2,200
3	64.6	62.4	79.4	79.4	83.5	2,200	79.5	79.5	83.5	2,200
4	63.7	61.3	65.3	65.3	77.2	2,200	65.3	65.3	77.2	2,200
5	63.0	60.8	69.4	69.4	578.2	2,200	69.4	69.4	78.2	2,200
6	62.8	61.2	153.4	153.4	111.8	2,200	153.5	153.5	111.8	2,200
7	63.4	61.7	195.5	195.5	131.0	2,200	195.5	195.5	131.0	2,200
8	65.1	62.3	185.3	185.3	127.3	2,200	195.6	185.6	127.4	2,200
9	67.6	63.3	220.8	220.8	145.4	2,200	220.8	220.8	145.4	2,200
10	76.7	65.2-	285.9	286.9	192.3	2,200	285.9	286.9	182.4	2,200
11	74.0	67.5	432.3	432.3	276.7	2,200	432.3	432.3	27£.7	2,200
12	77.1	69.8	557.6	557.5	377.9	2,200	557.6	557.6	377.9	2,200
13	79.6	71.6	535.2	535.2	365.3	2,200	535.2	535.2	365.3	2,200

				¥c	skrisu			6:	turday	
	Tν	nira?	Conline	Chiller	Chiller	Storage	Conline	Chiller	Chiller	Storone
	DADE	りなおか	inad	inad	Desend	Storage Capacity (Ton-Hr)	look	i nad	Spend	Capacity
House	(F)	157	(Top)	(Ten)	(UM)	Capacity	171	L080	00mano 11.51	Lapacity
וטטו	(1)	( )	(1011)	(10//)	( x # ;	(ION-HY)	(101)	(ion)	(K#)	(ION-Hr)
14	81.3	72.7	534.2	534.2	368.0	2,200	534.2	534.2	368.0	2,200
15	81.8	72.8	561.4	561.4	390.8	2,200	561.4	561.4	390.8	2,200
16	81.6	73.1	609.6	609.6	433.3	2,200	609.6	609.6	433.3	2,200
17	81.0	72.7	678.8	630.0	450.0	2,200 2,151	678.8	630.0	450.0	2,151
18	80.0	71.6	665.1	630.0	445.9	2,116 2,116 2,116 2,116 2,116	665.1	630.0	445.9	2.116
19	78.7	71.3	542.0	542.0	369.9	2,116	542.0	542.0	369.9	2,118
20	77.1	72.0	496.4	496.4	335.9	2,116	496.4	496.4	335.9	2,116
21	75.3	71.8	448.1	448.1	299.1	2,116	448.1	448.1	299.1	2,116
22	73.3	71.0	338.5	338.5	224.9	2,116	338.5	338.5	224.9	2,116
23	71.3	68.9	227.4	227.4	158.6	2,116	227.4	227.4	158.6	2,116
24	69.4	66.8	158.1	158.1	121.6	2,116 2,116	158.1	158.1	121.6	2,116
	Tv	nical	Cooling	Chiller	Chiller	Storage	Conline	Chiller	Chiller	Storage
	DADE	GAME	load	load	Desand	Camarity	Inad	had	Sesand	Canarity
Hour	(F)	(F)	(Inn)	(Inn)	(18)	Capacity (Ton-Hr)	(Ton)	(Ton)	(14)	(Ten-Hr)
								•		
	67.6	65.3	125.9	211.4	192.1	2,200 2,200	125.9	211.4	192.1	2,200
2		63.9	102.7	102.7	94.1	2,200	102.7	102.7	94.1	2,200
3		62.4	79.5	79.5	83.5	2,200	79.5	79.5	83.5	2,200
4	63.7	61.3	65.3	65.3	77.2	2,200 2,200 2,200	65.3	65.3	77.2	2,200
5		60.8	69.4	69.4	78.2	2,200	69.4	69.4	78.2	2,200
6	62.8	61.2	153.5	153.5	111.8	2,200 2,200	153.5	153.5	111.8	2,200
7	63.4	61.7	195.5	195.5	131.0	2,200	195.5	195.5	131.0	2,200
8	65.1	62.3	185.6	185.6	127.4	2,200	185.6	185.6	127.4	2,200
9	67.6	63.3	220.8	220.8	145.4	2,200	220.8	220.8	145.4	2,200
10		65.2	286.9	286.9	182.4	2,200 2,200 2,200 2,200 2,200 2,200	296.9	286.9	182.4	2,200
11	74.0	67.5	432.3	432.3	276.7	2,200	432.3	432.3	276.7	2,200
12	77.1	69.8	557.5	557.6	377.9	2,200	557.6	557.6	377.9	2,200
13	79.6	71.6	335.2	535.2	365.3	2,200	535.2	535.2	365.3	2,200
14	81.3	72.7	534.2	534.2	368.0	2,200 2,200 2,200	534.2	534.2	368.0	2,200
15	81.8	72.8	561.4	561.4	390.8	2,200	561.4	561.4	390.8	2,200
16	81.6	73.1	609.6	609.6	433.3	2,200 2,151	609.6	609.6	433.3	2,200
17	81.0	72.7	678.8	630.0	450.0	2,151	678.9	630.0	450.0	2,151
18	80.0	71.6	665.1	630.0	445.9	2,116	665.1	630.0	445.9	2,116
19	78.7	71.3	542.0	542.0	369.9	2,116 2,116 2,116 2,116	542.0	542.0	369.9	2,116
20	77.1	72.0	496.4	496.4	335.9	2,116	496.4	496.4	335.9	2,116
21	75.3	71.8	448.1	448.1	299.1	2,116	448.1	448.1	299.1	2,116
22		71.0	338.5	338.5	224.9	2,116	338.5	338.5	224.9	2,116
23		58.9	227.4	227.4	158.6	2,116	227.4	227.4	158.6	2,116
24	69.4	66.8	158.1	158.1	121.6	2,116 2,116 2,116 2,116 2,116	158.1	158.1	121.6	2,116

---- BUILDING COOLING DEMANDS AND THERMAL STORAGE----

July

			Design						
	Desi	ign	Cooling		-	Storage			
	DADB	DAWB	Load	Load	Demand	Capacity			
Hour	(F)	(F)	(Ton)	(Ton)	(k#)	(Ton-Hr)			
1	73.4	68.8	258.3	343.8	313.0	2,200			
2	72.3	67.9	206.7	206.7	146.4	2,200			
3	71.4	67.2	185.6	185.6	135.0	2,200			
4	70.7	67.0	180.9	180.9	132.5	2,200			
5	70.5	66.9	252.9	252.9	168.0	2,200			
6	71.0	67.4	325.9	326.9	209.4	2,200			
7	72.1	68.4	380.7	380.7	244.4	2,200			
8	74.1	69.3	401.4	401.4	260.1	2,200			
9	77.0	70.1	420.5	420.6	275.2	2,200			
10	80.4	71.4	494.4	494.4	332.6	2,200			
11	84.2	73.3	672.3	630.0	452.3	2,158			
12	87.8	75.5	775.6	630.0	450.7	2,012			
13	90.5	76.5	733.0	630.0	464.6	1,909			
14	92.3	76.8	763.3	630.0	465.8	1,776			
15	93.0	77.0	805.4	630.0	466.6	1,600			
16	92.3	76.7	891.8	630.0	465.4	1,339			
17	90.8	75.3	889.6	630.0	459.9	1,079			
18	88.3	74.2	860.2	630.0	455.7	849			
19	85.4	72.9	714.1	630.0	450.8	765			
20	82.4	73.4	680.5	630.0	452.6	714			
21	80.0	73.0	641.2	630.0	451.1	703			
22	77.7	72.3	559.5	559.5	387.6	703			
23	75.9	70.6	426.3	425.3	280.4	703			
24	74.6	69.4	280.2	280.2	187.6	703			

							Saturday			
	Ty	pical	Cooling	Chiller	Chiller	Storage	Cooling	Chiller	Chiller	Storage
	DADE	DAMB	Load	Load	Demand	Capacity	Load	Load	Demand	Capacity
Hour	(F)	(F)	(Ton)	(Ton)	(k₩)	(Ton-Hr)	(Ton)	(Ton)	(k#)	(Ton-Hr)
1	74.3	71.0	259.7	485.0	476.6	928	265.3	485.0	476.6	1,782
2	71.9	68.8	219.9	485.0	467.7	1,192	214.6	485.0	467.7	2,051
3	69.9	67.0	167.1	485.0	460.5	1,509	167.3	318.4	283.8	2,200
4	69.3	65.9	152.3	485.0	456.3	1,841	152.7	152.7	117.9	2,200
5	67.4	65.2	203.0	485.0	453.6	2,121	203.1	203.1	140.2	2,200
6	67.0	64.9	256.9	337.4	295.6	2,200	256.9	256.9	166.1	2,200
7	67.5	65.3	274.1	274.1	175.8	2,200	274.2	274.2	175.9	2,200
9	68.8	65.6	262.6	262.6	170.5	2,200	262.6	262.6	170.5	2,200
9	70.9	65.7	248.7	248.7	163.5	2,200	248.7	248.7	163.5	2,200
10	73.6	66.5	305.3	305.3	195.2	2,200	305.3	305.3	195.2	2,200
11	76.7	67.9	454.0	454.0	293.0	2,200	454.0	454.0	293.0	2,200
12	79.9	69.9	581.5	581.5	398.0	2,200	581.5	581.5	398.0	2,200
13	83.0	71.3	563.2	563.2	387.4	2,200	563.2	563.2	387.4	2,200

Trane Air Conditioning Economics By: C.D.S. MARKETING

								,		
		pical				Storage		Chiller	Chiller	Storage
	DADE	DAME	Load		Demand	Capacity	Load		Demand	Capacity
Hour	(F)	(F)	(Ton)	(Ten)	(k#)	(Ton-Hr)	(naT)	(Ton)	(kW)	(Ton-Hr)
14	85.7	72.5	597.7	597.7	420.7	2,200	597.7	597.7	420.7	2,200
15	97.8	73.9	654.3	630.0	454.5	2,176	654.3	630.0	454.5	2,176
16	89.1	75.3	737.3	630.0	459.9	2,068	737.3	630.0	459.9	2,068
17	89.5	75.5	810.6	630.0	460.7	1,888	810.6	630.0	460.7	1,898
18	89.2	76.2	803.8	630.0	463.4	1,714	803.8	630.0	463.4	1,714
19	88.3	76.7	700.3	630.0	465.4	1,644	700.3	630.0	465.4	1,644
20	86.7	79.6	684.0	630.0	472.9	1,590	684.0	630.0	472.9	1,590
21	84.7	78.8	656.5	630.0	473.7	1,563	656.5	630.0	473.7	1,563
22	82.3	78.0	549.7	549.7	398.5	1,563	549.7	549.7	398.5	1,563
23	79.6	75.4	419.7	419.7		1,563				1,563
24	76.9	73.0	325.9	325.9	222.1	1,563	325.9		222.1	1,563
						•				
	Ty	pical	Cooling			Storage		Chiller		
	DADB	DAMB	Load	Load	Demand	Capacity	Load	Load	Demand	Capacity
Hour	(F)	(F)	(Ton)	(Ton)	(k#)	(Ton-Hr)	(Ton)	(Ton)	(k#)	(Ton-Hr)
1	74.3	71.0	265.3	485.0		1,782		485.0		1,782
2	71.9	8.88	214.6	485.0		2,051	214.6	485.0		2,051
3	69.9	67.0	167.3	318.4	283.8	2,200	167.3	318.4		2,200
4	68.3	65.9	152.7	152.7	117.9	2,200	152.7	152.7	117.9	2,200
5	67.4	65.2	203.1	203.1	140.2	2,200	203.1	203.1	140.2	2,200
6	67.0	64.9	256.9	256.9	166.1	2,200	256.9	256.9	166.1	2,200
7	67.5	65.3	274.2	274.2	175.9	2,200	274.2	274.2	175.9	2,200
8	68.8	65.6	262.6	262.6	170.5	2,200	262.6	262.6	170.5	2,200
9	70.9	65.7	248.7	248.7		2,200	248.7			2,200
10	73.6	66.5	305.3	305.3	195.2	2,200	305.3	305.3		2,200
11	76.7	67.9	454.0	454.0	293.0	2,200	454.0			2,200
12	79.9	69.9	581.5	581.5	398.0	2,200	581.5			2,200
13	83.0	71.3	563.2	563.2		2,200	563.2			2,200
14	85.7	72.5	597.7	597.7		2,200	597.7			2,200
15	87.8	73.9	654.3	630.0		2,176				2,176
16	89.1	75.3	737.3	630.0		2,068				2,068
17	89.5	75.5	810.6	630.0	460.7	1,888		630.0		1,888
18		76.2			463.4	1,714			463.4	
19	88.3	75.7	700.3	630.0	465.4	1,644	700.3			1,644
20	86.7	78.6	684.0	630.0		1,590	684.0			1,590
21	84.7	78.8	656.5	630.0		1,563	656.5			1,563
22	82.3	78.0	549.7	549.7	,	1,563	549.7			1,563
23	79.6	75.4	419.7	419.7		1,563	419.7			1,563
24	76.9	73.0	325.9	325.9	222.1	1,563	325.9	325.9	222.1	1,563

---- BUILDING COOLING DEMANDS AND THERMAL STORAGE----

August

			Design						
	Desi	ign	Cooling	Chiller	Chiller	Storage			
	DADE	DAWR	Load	Load	Demand	Capacity			
Hour	(F)	(F)	(Ton)	(Ton)	{k#}	(Ton-Hr)			
	70.5	64.5	164.0	485.0	451.0	1 007			
1			133.5	452.1	409.4	1,883			
2	69.5	63.5				2,200			
3	68.7	63.0	120.1	120.1	100.2	2,200			
4	68.1	62.4	107.0	107.0	94.1	2,200			
5	67.9	62.6	162.3	162.3	117.6	2,200			
6	68.3	63.2	240.7	240.7	154.8	2,200			
7	69.3	64.1	261.5	261.5	166.9	2,200			
8	71.1	64.9	292.4	292.4	184.6	2,200			
9	73.7	66.1	328.4	328.4	207.2	2,200			
10	75.8	67.2	406.9	406.9	258.8	2,200			
11	80.2	68.9	583.6	583.6	396.4	2,200			
12	83.4	70.6	695.3	630.0	442.3	2,135			
13	85.8	71.5	664.3	£30.0	445.6	2,100			
14	87.5	72.5	698.6	630.0	449.3	2,032			
15	88.1	72.7	727.3	630.0	450.0	1,934			
16	87.5	71.7	794.2	630.0	446.3	1,770			
17	86.0	70.6	806.4	630.0	442.3	1,594			
18	83.8	69.7	758.7	630.0	439.1	1,465			
19	81.2	68.5	598.2	598.2	407.5	1,465			
20	78.6	58.7	545.2	545.2	364.4	1,465			
21	76.4	68.8	454.4	454.4	295.6	1,465			
22	74.3	67.6	321.1	321.1	206.5	1,465			
23	72.7	66.4	220.8	220.8	150.8	1,465			
24	71.5	65.3	194.9	194.9	136.4	1,465			
						-			

				#E	ekday	Saturday				
	Ту	pical	Cooling	Chiller	Chiller	Storage	Cooling	Chiller	Chiller	Storage
	DADB	DAMB	Load	Load	Demand	Capacity	Load	Load	Demand	Capacity
Hour	(F)	<b>(F)</b>	(Ten)	(Ton)	(k₩)	(Ton-Hr)	(Ton)	(Ton)	(k量)	(Ton-Hr)
1	70.1	65.3	145.1	485.0	454.0	1,804	150.5	200.7	184.2	2,200
2	68.2	63.5	116.3	485.0	447.3	2,171	115.6	115.6	98.9	2,200
3	66.6	62.2	88.4	119.1	124.0	2,200	88.6	88.6	86.7	2,200
4	65.4	61.1	72.4	72.4	79.6	2,200	72.3	72.3	79.6	2,200
5	64.6	60.7	101.2	101.2	< 89.9	2,200	101.5	101.5	90.1	2,200
6	64,4	50.7	175.6	175.6	120.6	2,200	175.5	175.5	120.6	2,200
7	64.9	61.2	173.0	173.0	120.2	2,200	173.0	173.0	120.2	2,200
9	66.3	61.6	179.8	179.8	123.8	2,200	180.0	180.0	123.9	2,200
9	68.5	62.5	178.1	178.1	124.4	2,200	178.0	178.0	124.4	2,200
10	71.4	63.6	250.5	250.5	160.4	2,200	250.6	250.6	160.5	2,200
11	74.5	65.1	396.0	395.0	246.7	2,200	398.0	396.0	246.7	2,200
12	77.6	66.8	504.8	504.8	327.3	2,200	504.8	504.8	327.3	2,200
13	80.5	68.2	495.1	495.1	323.9	2,200	495.1	495.1	373.0	2,200

COLD THERMAL STORAGE - ALTERNATIVE 1 B HOUR ICE BUILD, 16 HOUR CHILLER RUN

	Weekday						Saturday			
	Ty	pical	Cooling	Chiller	Chiller	Storage	Cooling			
	DADB	DAMB	Load	Load	Desand	Storage Capacity	Load	Load	Demand	Canacity
Hour	(F)	(F)	(Ton)	(Ton)	(kW)	(Ton-Hr)	(Tora)	(Inn)	(14)	(Inn-Hr)
			(	(,,,,,	( ,	(10 //	( , , , ,	(1011)	(80)	(10:1111
14	82.7	69.7	525.9	525.9	352.0	2,200	525.9	575.9	352.0	2,200
15	84.2	70.7	562.3	562.3	384.6	2,200	582.3	562.3	384.6	2,200
16	84.6	70.5	612.6	612.6	384.6 426.7	2,200	562.3 612.6	617.6	426.7	2,200
17	84.4	70.4	668.2			2,162	468.2	430.0	441.6	2,162
18	83.6	70.7	640.3		442.7	2,152	640.3	0.074	442.7	
19		70.7	496.1		331.8	2 152	496.1	494 1	331.8	2,152
20		71.9	476.3	474 3	320.2	2 152	476 R	474 3		2,152
21		72.4	433.7	475.0 477.7	320.2 290.3	2,152 2,152	473.3 473.7	473.7	320.2 290.3	2,152
22		71.1	770.1 770.5	733.7	270.3	2,102	730.5	730.5	270.3	2,152
		69.3	0.47 7	00010	117.5	2,102	0.00.0	200.0	117.5	2,132
23		27.5	293.3	243.3	157.3	2,152 2,152 2,152	240.0	243.3	107.3	2,152
24	72.2	67.2	198.3	198.3	141.1	2,152	198.3	198.3	141.1	2,152
				6	unday			»	nnday	
	Tvi	pical				Storage				
			Locating	l nod	Durant,	Canadity	Lood	Lood	Doesed.	Canacity
Hour	UNUD (E)	15 )	/7==\	(T)	11.07	Capacity (Ton-Hr)	(7)	(70-)	VEMBIO (LU)	(Ton-Ue)
וטטו	(1)	(	(1011)	(1001)	(K#;	(	(1011)	(104)	(58)	(1011-01)
1	70.1	65.3	150.5	200.7	184.2	2,200	150.5	200.7	184.2	2,200
2	68.2	63.5	115.6	115.6	98.9	2,200 2,200 2,200	115.6	115.6	98.9	2,200
3		62.2	88.6	88.6	85.7	2,200	89.6	83.6	86.7	2,200
4		61.1	72.3	72.3	86.7 79.6	2,200	72.3	72.3	79.6	2,200
5	64.6	60.7	101.5	101.5	90.1	2,200	101.5	101.5	90.1	2,200
6	64.4	60.7	101.5 175.5	175.5	170.4	2.200	175.5	175.5	120.6	2,200
7	64.9	61.2	173.0	173.0	120.2	2,200 2,200 2,200	173.0	173.0	120.2	2,200
8		61.6	180.0	180.0	127.9	2 200	190.0	180.0	127.9	2,200
9		62.5	178.0	179.0	172 4	2,200 2,200	178.0	178.0	124 4	2,200
10	71.4	63.6	250.6		160.5	2,200	250.4	250.4	160.5	2,200
11	74.5	65.1	396.0	200.0	246.7	2,200 2,200 2,200	201.0	394 6	245.7	
12	77.6	66.8	504.8		327.3	2,200	500.0	575.V	327.3	2,200
13	80.5	68.2	495.1		327.3 777.0	2,200	307.0 405.1	405 t	317.3 777 D	2,200
14	82.7		525.9	47J.1	323.7 755.0	2,200 2,200	#73,1 #0# 0	77.5.1 EDE D	323.9 352.0	2,200
		69.7		323.7	207.0	2,200	525.9	323.7	302.0	2,200
15	84.2	70.7	562.3		384.6	2,200 2,200 2,162	301.0	562.3		2,200
16	84.6	70.5	612.6	612.6	426.7	2,200	617.5	617.6	426.7	2,200
17	84.4	70.4	668.2		441.6	2,162	668.2	630.0	441.6	2,162
18	83.6	70.7	640.3	630.0	442.7	2,152 2,152	640.3	630.0	442.7	2,152
19	82.4	70.7	496.1		331.8	2,152	496.1	770:1	20770	29232
20	80.8	71.9	476.3		320.2	2,152	476.3	476.3		2,152
21	78.9	72.4	433.7	433.7	290.3	2,152 2,152	433.7	433.7	290.3	2,152 2,152
22	76.8	71.1	330.5	330.5	220.3	2,152	330.5	330.5	220.3	2,152
23		69.3	243.3	243.3	167.5	2,152	243.3	243.3	167.5	2,152
24	72.2	67.2	198.3	198.3	141.1	2,152 2,152	198.3	198.3	141.1	2,152

---- BUILDING COOLING DEMANDS AND THERMAL STORAGE----

September

			Design						
	Desi	gn	Cooling	Chiller	Chiller	Storage			
	DADB	DAWB	Load	Load	Demand	Capacity			
Hour	(F)	(F)	(Ton)	(Ton)	(kW)	(Ten-Hr)			
1	64.3	60.7	76.6	126.8	126.4	2,200			
2	63.3	59.8	60.2	60.2	71.7	2,200			
3	62.4	59.2	48.1	48.1	57.2	2,200			
4	61.8	58.5	35.4	35.4	42.0	2,200			
5	61.6	58.3	42.2	42.2	50.2	2,200			
5	62.0	58.7	54.3	54.3	64.5	2,200			
7	63.1	59.8	142.1	142.1	105.5	2,200			
8	64.9	61.3	146.5	146.5	109.0	2,200			
9	67.5	62.3	207.6	207.6	137.5	2,200			
10	70.6	63.4	305.6	305.6	188.9	2,200			
11	74.0	65.1	491.7	491.7	312.9	2,200			
12	77.3	66.6	611.3	611.3	412.3	2,200			
13	79.7	68.1	579.7	579.7	390.6	2,200			
14	81.3	68.9	596.3	596.3	407.2	2,200			
15	81.9	69.3	623.8	623.8	432.2	2,200			
16	81.3	68.8	684.1	630.0	435,9	2,146			
17	79.9	68.2	694.6	630.0	433.8	2,081			
18	77.7	67.0	653.5	630.0	429.7	2,058			
19	75.0	66.9	506.2	506.2	328.6	2,058			
20	72.4	66.6	369.5	369.5	233.2	2,058			
21	70.2	65.3	283.2	283.2	180.5	2,058			
22	68.1	63.7	169.8	169.8	127.4	2,058			
23	66.5	62.5	112.6	112.5	96.5	2,058			
24	65.3	61.6	96.5	96.5	89.1	2,058			

				#E	ekday		Saturday			
	Ty	pical	Cooling	Chiller		Storage	Cooling	Chiller	Chiller	Storage
	DADB	BAWB	Load	Load	Demand	Capacity	Load	Load	Demand	Capacity
Hour	(F)	{F}	(Ton)	(Ton)	(k∰)	(Ton-Hr)	(Ton)	(Ton)	(F#)	(Ton-Hr)
1	63.9	61.5	68.5	212.3	184.2	2,200	74.8	74.8	80.9	2,200
2	62.0	59.7	47.6	47.6	56.8	2,200	48.1	48.1	57.3	2,200
3	60.4	58.4	26.6	26.6	31.6	2,200	26.6	26.6	31.6	2,200
4	59.2	57.1	15.4	15.4	18.3	2,200	15.4	15.4	18.3	2,200
5	58.4	56.3	19.2	19.2	< 22.8	2,200	19.2	19.2	22.8	2,200
6	58.2	56.1	24.3	24.3	28.9	2,200	24.3	24.3	28.9	2,200
7	58.7	56.7	8.4	0.0	0.0	2,200	8.4	0.0	0.0	2,200
8	60.1	57.9	87.6	87.6	83.9	2,200	87.6	87.5	83.9	2,200
Ģ	62.4	58.6	79.2	79.2	80.8	2,200	79.2	79.2	80.8	2,200
10	65.2	59.6	142.2	142.2	105.5	2,200	142.9	142.9	105.8	2,200
11	68.3	81.1	275.3	275.3	168.4	2,200	275.3	275.3	168.4	2,200
12	71.5	62.7	415.0	415.0	253.6	2,200	415,0	415.0	253.6	2,200
13	74.3	64.6	413.9	413.9	257.3	2,200	414.3	414.3	257.5	2,200

Trane Air Conditioning Economics
By: C.D.S. MARKETING

				No	nkday		Saturday			
	Tue					Storage				
	DADE		Load	Unille:	Donand Unitie:	Capacity	inad	inad	Desend	Famority
U			(Ten)	(Top)	16 m c 11 c 11 c 1	(Ton-Hr)	(Inn)	(Inn)	(144)	(Ton-Hr)
Hour	(F)	(F)	(100)	(1011)	(K#)	(Turr-nr)	(1011)	(1011)	( K # }	(10): 10: }
14	76.6	66.0	456.6	456.6	289.9	2,200	456.6			
15	78.0	67.1	465.5	465.5	299.1	2,200	465.5	465.5		2,200
16	78.5	67.5	514.5	514.5	336.7	2,200	514.5	514.5	336.7	2,200
17	78.2	67.9	550.9	550.9	365.5	2,200	550.9	550.9	366.5	2,200
18	77.5	68.0	499.0	499.0	326.3	2,200	499.0	499.0	326.3	2,200
19	76.3	69.3	379.7	379.7	245.9	2,200	379.7	379.7	245.9	2,200
20	74.7	70.0	348.0	348.0	228.1	2,200	348.0	348.0	228.1	2,200
21	72.7	69.0	290.0	290.0		2,200	290.0	290.0	192.2	2,200
22	70.6	67.3	190.0	190.0	137.3	2,200	190.0	190.0	137.3	2,200
23		65.4	121.4		103.6	2,200		121.4	103.6	2,200
24	66.1	63.6	104.2		94.3	2,200		104.2	94.3	2,200
									landay	
	_			<u>-</u>	unday	D1	Pline	Ph: 11	Chiller	Ctorons
				Chiller	Chiller	Storage	rective	Unilier	CHILLES	Consider
	DADB	DAMB				Capacity				Capacity
Hour	(F)	(F)	(Ton)	(Ton)	(k¥)	(Ton-Hr)	(ion)	(IDN)	(K#)	(Ton-Hr)
1	63.9	61.5	74.8	74.8	80.9	2,200	74.8	74.8 48.1	80.9	2,200
2	62.0	59.7	48.1			2,200	48.1	48.1	57.3	2,200
3	60.4	58.4	26.6	26.6	31.6	2,200		26.6	31.6	2,200
4	59.2	57.1	15.4			2,200		15.4	18.3	2,200
5	58.4	56.3	19.2			2,200				2,200
6	58.2	56.1	24.3			2,200				2,200
7	58.7	56.7	8.4			2,200		0.0		2,200
8	60.1	57.9	87.6	87.6		2,200				2,200
9	62.4	58.6	79.2			2,200				2,200
10	65.2	59.6	142.9			2.200	147.9			
11	68.3	61.1	275.3				275.3			
12	71.5	62.7	415.0			2,200	415.0			
13	74.3		414.3				414.3			
14	75.6			456.6		•				
15	78.0			465.5		2,200				
16	78.5		514.5			2,200	514.5			
17	78.2	67.9	550.9			2,200 2,200	550.9			2,200
18					326.3				326.3	
19	76.3									
20	74.7					2,200				
21	72.7					2,200				
22	70.6	67.3								
						•				2,200
23	68.3	65.4				2,200	104.2			2,200
24	66.1	63.6	104.2	104.2	74,3	2,200	107.1	107:1	: সকল	+4+v2

## ECO IH-2

---- BUILDING COOLING DEMANDS AND THERMAL STORAGE----

June

			Design						
	Desi	ign	Cooling	Chiller	Chiller	Storage			
	DADB	DAWB	Load	Load	Demand	Capacity			
Hour	(F)	(F)	(Ten)	(Ton)	(k₩)	(Ton-Hr)			
1	68.7	65.1	0.0	0.0	0.0	5,000			
2	67.8	64.4	0.0	0.0	0.0	5,000			
3	67.0	63.5	0.0	0.0	0.0	5,000			
4	66.4	62.7	0.0	0.0	0.0	5,000			
5	66.3	62.7	0.0	0.0	0.0	5,000			
6	66.6	63.7	0.0	0.0	0.0	5,000			
7	67.6	64.5	0.0	0.0	0.0	5,000			
. 8	69.3	65.1	0.0	0.0	0.0	5,000			
9	71.8	66.0	65.3	65.3	84.5	5,000			
10	74.6	67.6	109.2	109.2	142.9	5,000			
11	77.8	69.8	241.8	241.8	208.0	5,000			
12	80.9	71.9	384,5	0.0	0.0	4,611			
13	83.2	73.5	353.7	0.0	0.0	4,254			
14	84.7	74.4	435.0	0.0	0.0	3,816			
15	25.3	74.6	542.1	0.0	0.0	3,271			
16	84.7	74.5	692.4	0.0	0.0	2,586			
17	83.4	73.5	806.8	0.0	0.0	1,777			
18	81.3	71.5	768.0	768.0	508.9	1,777			
19	78.8	70.1	652.3	652.3	427.2	1,777			
20	76.3	70.0	591.1	591.1	390.2	1,777			
21	74.2	69.5	546.4	546.4	362.4	1,777			
22	72.3	68.7	422.4	422.4	292.5	1,777			
23	70.8	67.1	246.2	246.2	203.7	1,777			
24	69.7	65.8	170.5	170.5	168.7	1,777			

				#e	ekday		Saturday			
	Ty	pical	Cooling	Chiller	Chiller	Storage	Cooling	Chiller	Chiller	Storage
	DADE	DAME	Load	Load	Demand	Capacity	Load	Load	Demand	Capacity
Hour	(F)	(F)	(Ton)	(Ton)	(k¥)	(Ton-Hr)	(Ton)	(Ton)	(kW)	(Ton-Hr)
1	67.6	65.3	119.5	885.0	828.4	2,541	125.9	885.0	828.4	2,264
2	66.0	63.9	103.2	885.0	818.9	3,321	102.7	885.0	818.9	3,044
3	64.6	62.4	79.4	885.0	.808.9	4,123	79.5	885.0	808.9	3,847
4	63.7	61.3	65.3	885.0	801.9	4,940	65.3	885.0	801.9	4,664
5	63.0	60.8	69.4	133.4	174.9	5,000	69.4	409.1	348.9	5,000
6	62.8	61.2	153.4	153.4	153.3	5,000	153.5	153.5	153.4	5,000
7	63.4	61.7	195.5	195.5	170.4	5,000	195.5	195.5	170.4	5,000
8	65.1	62.3	195.3	185.3	167.6	5,000	185.6	185.6	167.7	5,000
9	67.6	63.3	220.8	220.8	184.2	5,000	220.8	220.8	184.2	5,000
10	70.7	65.2	286.9	285.9	217.1	5,000	285.9	286.9	217.2	5,000
11	74.0	67.5	432.3	432.3	293.6	5,000	432.3	432.3	293.6	5,000
12	77.1	69.8	557.6	0.0	0.0	4,438	557.6	0.0	0.0	4,438
13	79.6	71.6	535.2	0.0	0.0	3,900	535.2	0.0	0.0	3,900

Trane Air Conditioning Economics By: C.D.S. MARKETINE

		Weekday					Saturday			
	T	1	P1:	#P	ekoay	Ch				
		leai	_			Storage			Chiller	
11	DADE	DAME	Load	Load		Capacity		Load		Capacity
Hour	(F)	(F)	(Ton)	(Tan)	(kW)	(Ton-Hr)	(Ton)	(Ton)	(k₩)	(Ton-Hr)
14	81.3	72.7	534.2	0.0	0.0	3,362	534.2	0.0	0.0	3,362
15	81.8	72.8	561.4	0.0	0.0	2,798	561.4	0.0	0.0	2,798
16	81.6	73.1	609.6	0.0	0.0	2,186	609.6	0.0	0.0	2,186
17	81.0	72.7	678.8	0.0	0.0	1,506	678.8	0.0	0.0	1,506
18	80.0	71.6	665.1	665.1	442.2	1,506	665.1	665.1	442.2	1,506
19	78.7	71.3	542.0	542.0	367.2	1,506	542.0	542.0	367.2	1,506
20	77.1	72.0	496.4	496.4	344.0	1,506	496.4	496.4	344.0	1,506
21	75.3	71.8	448.1	448.1	316.5	1,506	448.1	448.1	316.5	1,506
22	73.3	71.0	338.5	338.5	257.1	1,506	338.5	338.5	257.1	1,506
23	71.3	68.9	227.4	227.4	199.5	1,506	227.4	227.4	199.5	1,506
24	69.4	66.8	158.1	158.1	165.7	1,506	158.1	158.1	165.7	1,506
				9	innday			H	londay	
	Ty	pical				Storage				Storage
	DADE	DAWB	Load	Load				Load	Demand	Capacity
Hour	(F)	(F)	(Ton)	(Ton)	(k₩)	(Ton-Hr)	(Ton)	(Ton)	(kW)	(Ton-Hr)
1	67.6	65.3	125.9	885.0	828.4	2,264	125.9	885.0	323.4	2,254
2	66.0	63.9	102.7	885.0		3,044	102.7			3,044
3	64.6	62.4	79.5			3,847	79.5			3,847
4	63.7	61.3	55.3	885.0		4,664	65.3			4,654
T .	63.0	60.8	69.4	409.1		5,000	69.4			5,000
6	62.8	61.2	153.5			5,000	153.5			5,000
7	63.4	61.7	195.5			5,000	195.5			5,000
8	65.1	62.3	185.6	185.6		5,000	185.6			5,000
9	67.6	63.3	220.9	220.8		5,000	220.8			5,000
10	70.7	65.2	286.9			5,000	286.9			5,000
11	74.0	67.5	432.3			5,000	432.3			5,000
12	77.1	69.8	557.6	0.0	0.0	4,438	557.6			4,438
13	79.6	71.6	535.2			3,900	535.2			3,900
14	81.3	72.7	534.2			3,362	534.2			3,362
15	81.8	72.8	561.4			2,798	561.4			2,798
16	81.6	73.1	609.6			2,186	609.6			2,186
17	81.0	72.7	678.8			1,506	678.8			1,506
18	80.0	71.6	665.1		442.2	1,506	665.1			1,506
19	78.7	71.3				1,506	542.0			1,506
20	77.1	72.0				1,506	496.4			1,506
21	75.3	71.8				1,506	448.1			1,506
22	73.3	71.0				1,506	338.5			1,506
23	71.3	68.9				1,506	227.4			1,506
24	69.4	56.8				1,506	158.1			1,506

---- BUILDING COOLING DEMANDS AND THERMAL STORAGE----

July

			Design					
	Desi	ign	Cooling	Chiller	Chiller	Storage		
	DADE	DAMB	Load	Load	Demand	Capacity		
Hour	(F)	(F)	(Ton)	(Ton)	(kW)	(Ton-Hr)		
1	73.4	68.8	258.3	885.0	853.3	2,131		
2	72.3	67.9	206.7	885.0	845.8	2,808		
3	71.4	67.2	185.6	885.0	841.8	3,505		
4	70.7	67.0	180.9	885.0	840.3	4,205		
5	70.5	66.9	252.9	885.0	839.6	4,835		
É	71.0	67.4	325.9	495.5	446.5	5,000		
7	72.1	68.4	380.7	380.7	270.4	5,000		
8	74.1	69.3	401.4	401.4	283.7	5,000		
9	77.0	70.1	420.6	420.6	296.2	5,000		
10	80.4	71.4	494.4	494.4	340.6	5,000		
11	84.2	73.3	672.3	672.3	455.0	5,000		
12	87.8	75.5	775.6	0.0	0.0	4,220		
13	90.5	76.5	733.0	0.0	0.0	3,484		
14	92.3	76.8	763.3	0.0	0.0	2,718		
15	93.0	77.0	805.4	0.0	0.0	1,910		
16	92.3	76.7	891.8	0.0	0.0	1,017		
17	90.8	75.3	889.5	0.0	0.0	127		
18	88.3	74.2	860.2	860.2	589.6	127		
19	85.4	72.9	714.1	714.1	479.9	127		
20	82.4	73.4	680.5	680.5	460.7	127		
21	80.0	73.0	641.2	641.2	434.0	127		
22	77.7	72.3	559.5	559.5	381.4	127		
23	75.9	70.6	426.3	426.3	300.8	127		
24	74.6	69.4	280.2	280.2	224.7	127		

				#e	ekday		Saturday			
	Typ	pical	Cooling	Chiller	Chiller	Storage	Cooling	Chiller	Chiller	Storage
	DADB	DAMB	Load	Load	Demand	Capacity	Load	Load	Demand	Capacity
Hour	(F)	(F)	(Ton)	(Ton)	(kW)	(Ton-Hr)	(Ton)	(Ton)	(kW)	(Ton-Hr)
1	74.3	71.0	259.7	885.0	869.7	752	265.3	885.0	869.7	1,657
2	71.9	8.83	219.9	885.0	853.3	1,416	214.6	885.0	853.3	2,325
3	69.9	67.0	167.1	885.0	840.3	2,133	167.3	885.0	840.3	3,042
4	68.3	65.9	152.3	885.0	832.6	2,864	152.7	885.0	832.6	3,772
5	67.4	65.2	203.0	885.0	-B27.7	3,544	203.1	885.0	827.7	4,451
É	67.0	64.9	256.9	885.0	825.6	4,169	256.9	809.4	738.5	5,000
7	67.5	65.3	274.1	885.0	828.4	4,777	274.2	274.2	211.7	5,000
8	68.8	65.6	262.6	489.7	432.6	5,000	262.6	252.5	207.3	5,000
9	70.9	65.7	248.7	248.7	201.5	5,000	248.7	248.7	201.5	5,000
10	73.6	66.5	305.3	305.3	228.9	5,000	305.3	305.3	228.9	5,000
11	76.7	67.9	454.0	454.0	305.2	5,000	454.0	454.0	306.2	5,000
12	79.9	69.9	581.5	0.0	0.0	4,414	581.5	0.0	0.0	4,414
13	83.0	71.3	563.2	0.0	0.0	3,848	563.2	0.0	0.0	3,848

Trane Air Conditioning Economics By: C.D.S. MARKETINS

				#e	ekday		Saturday				
	ĨVI	pical				Storage					
	DADE	DANB	Load	Load	Demand	Capacity	Load	Load	Demand	Capacity	
Hour	(F)	(F)		(Ton)		(Ton-Hr)	(Inn)				
1,02.	(. 1		(,,,,	(10//	(817)	(707, 111,	( , , , ,	(10//	(477)	(1011 111 )	
14	85.7	72.5	597.7	0.0	0.0	3,247	597.7	0.0	0.0	3,247	
15	87.8	73.9	654.3	0.0	0.0	2,590	654.3			2,590	
16	89.1	75.3	737.3	0.0	0.0	1,851	737.3	0.0		1,851	
17	89.5	75.5	810.6	0.0	0.0	1,039	810.6	0.0	0.0	1,039	
18	89.2	76.2	803.8	803.8	559.0	1,039	803.8	803.8	559.0	1,039	
19	88.3	76.7	700.3	700.3	490.3	1,037	700.3	700.3	490.3	1,039	
20	86.7	78.6	684.0	684.0	488.8	1,039	684.0	684.0	488.8	1,039	
21	84.7	78.8	656.5	656.5	471.2	1,039	656.5	656.5	471.2	1,039	
22	82.3	78.0	549.7	549.7		1,037	549.7			1,039	
							419.7			1,039	
23	79.6	75.4	419.7	419.7		1,039					
24	76.9	73.0	325.9	325.9	256.3	1,039	325.9	325.9	200.0	1,039	
				,					taadan		
	7	-:1									
		pical				Storage		Chiller	Demand	Storage Capacity	
	DADE	DAWB	Load		Demand				(kW)	/7U-)	
Hour	(F)	(F)	(Ton)	()on)	(k₩)	(Ton-Hr)	(Ton)	(101)	(K#)	(Ton-Hr)	
	74.7	24. 4	0/5 7	nne A	מ חות	1 /57	285.3		869.7	1,657	
1	74.3	71.0	265.3	885.0		1,657				2,326	
2	71.9	68.8	214.6	885.0		2,326				3,042	
3	69.9	67.0	167.3	885.0		3,042				•	
4	68.3	65.9	152.7	885.0		3,772	152.7			3,772	
5	67.4	65.2	203.1	885.0		4,451	203.1			4,451	
6	67.0	64.9	256.9	809.4		5,000	256.9			5,000	
7	67.5	65.3	274.2	274.2		5,000	274.2			5,000	
8	68.8	65.6	262.6	262.6	207.3	5,000	262.6			5,000	
9	70.9	65.7	248.7	248.7		5,000	248.7			5,000	
10	73.6	56.5	305.3	305.3		5,000	305.3			5,000	
11	76.7	67.9	454.0	454.0		5,000	454.0			5,000	
12	79.9	69.9	581.5	0.0		4,414	581.5			4,414	
13	83.0	71.3	563.2	0.0		3,848				3,849	
14	85.7	72.5	597.7	0.0		3,247				3,247	
15	87.8	73.9	654.3			2,590				2,590	
16	89.1	75.3	737.3			1,851				1,851	
17	89.5	75.5	810.6	0.0	0.0	1,039	810.5	0.0		1,039	
19	89.2	76.2	803.8	803.8	559.0	1,039	803.8	803.8	559.0	1,039	
19	88.3	76.7	700.3			1,039	700.3			1,039	
20	86.7	78.6	684.0	684.0	488.8	1,039	684.0	684.0	488.8	1,039	
21	84.7	78.8	656.5	656.5	471.2	1,039	656.5			1,039	
22	82.3	78.0	549.7		398.9	1,039	549.7	549.7	398.9	1,039	
23	79.6	75.4	419.7	419.7	313.1	1,039	419.7	419.7	313.1	1,039	
24	76.9	73.0	325.9			1,039	325.9		256.3	1,039	
						-					

---- BUILDING COOLING DEMANDS AND THERMAL STORAGE----

----- Design -----

August

	B		61:	PL:33	CL: 11	Storage				
	DADE:	Ligh DAUE	rooting	unilier	Chiller	Storage				
						Capacity				
Hour	(F)	<b>(</b> F)	(Ion)	(lon)	(KW)	(Ton-Hr)				
1	70.5	64.5	164.0	885.0	822.9	1,759				
2	69.5	63.5	133.5	885.0	816.2	2,509				
3	68.7	63.0	120.1	885.0	812.9	3,272				
4	48.1	62.4	107.0	885.0	808.9	2,509 3,272 4,047				
5		62.6	162.3	885.0	810.2	4,767				
6		63.2	240.7	477.9	411.4	5,000				
7		64.1	261.5	261.5	203.2	5,000				
8		64.9				5,000				
9						5,000				
10	76.8	67.2	406.9	406.9	279.8	5,000				
11		70 O	507 4	597 &	3011	5 000				
12		70.6	695.3	0.0	0.0	4,301 3,633				
13		71.5	7 524	0.0	0.0	3.633				
14	87.5	72.5	498.4	0.0	6.6	2,931				
15	88 1	72.0	777 3	0.0	0.0	2,202				
16	97.5	71 7	79A 2	0.0	6.0	1,406				
17	86.0				0.0					
18	83.8				494.2					
19	81.2	68.5	500 7	500.7	387.8					
20		68.7	270.1	585.5	750.5	598				
21		68.8	858 B	858 A	358.5 309.5	598				
22		67.6	701 1	701 1	239.2	578				
23	77.0	EL A	221.1	224.1	191.0	578				
	71.5	15 7	104 0	101 0	177.7	598				
24	71.3	60.0								
				Ne	ekday			Sa	turday	
	Ty	pical	Cooling	Chiller	Chiller	Storage	Cooling	Chiller	Chiller	Storage
	DADB	DAWR	Load	Load	Demand	Capacity	Load	Load	Demand	Capacity
Hour	(F)	(F)	(Ton)	(Ton)	(k¥)	Storage Capacity (Ton-Hr)	(Ton)	(Ton)	(k#)	(Ton-Hr)
1	70.1	65.3	145.1	885.0	828.4	1,338	150.5	885.0	828.4	2,347
2	68.2	63.5	116.3	885.0	816.2	2,105	115.6	885.0	816.2	3,114
3	66.6	62.2	88.4	885.0	807.6	2,900	88.6	885.0	807.6	3,908
4	65.4	61.1	72.4	885.0	800.6	3,710 4,491	72.3	885.0	800.6	4,718
5			101.2	885.0	798.1	4.491	101.5	387.5	332.9	5,000
			175.6	687.8	586.7	5,000	175.5	175.5	160.7	5,000
7	64.9		173.0			5,000	173.0			5,000
8	66.3		179.8			5,000	180.0			5,000
9	68.5					5,000				5,000
10	71.4		250.5			5,000	250.6		197.4	5,000
11	74.5		396.0			5,000	395.0			5,000
12	77.6	66.8			0.0	4,491	504.8		0.0	4,491
13	80.5	62.2	495.1	0.0	0.0	3,993	495.1	0.0	0.0	3,993
10	6416	DE 12	17512	670	V . V	23112				,

Trane Air Conditioning Economics By: C.D.S. MARKETING

		Weekday					Saturday				
	Typica!			Chiller	Chiller	Storage	Cooling				
	DADE	DANI	Load	i nad	Desard	Capacity	garrooo beal	last	Desard	Panarity	
Unum		(F)	(Ten)	(Inn)	(FM)	(Ton-Hr)	(Top)	(Top)	(6M)	(Ton-Hr)	
Hour	(F)	(F !	(108)	(1011)	( K# )	(100-01)	(1011)	(100)	(88)	(100 - m.)	
14	82.7	69.7	525.9	0.0	0.0	3,464	525.9	0.0	0.0	3,464	
15	84.2	70.7	562.3	0.0	0.0	2,898	562.3	0.0	0.0	2,898	
16	84.6	70.5	612.6	0.0	0.0	2,283	612.6	0.0	0.0	2,283	
17	84.4	70.4	668.2	0.0	0.0	1,513	669.2	0.0	0.0	1,613	
18	83.6	70.7	640.3	640.3	422.7	1,613	640.3	640.3	422.7	1,613	
19	82.4	70.7	496.1	496.1	338.9	1,613	496.1		338.9	1,613	
20	80.8	71.9	476.3	476.3	332.4	1,613	476.3		332.4	1,613	
21	78.9	72.4	433.7	433.7	310.8	1,613	433.7			1,613	
22	76.8	71.1	330.5	330.5	253.4	1,613	330.5			1,613	
23	74.5	69.3	243.3	243.3	207.5	1,613	243.3	243.3		1,513	
24	72.2	67.2	198.3	198.3	183.1	1,613	198.3	198.3	183.1	1,613	
			Sunday				Nonday				
	Tu	pical		Chiller	Chiller	Storage	Cooling	Chiller	Chiller	Storage	
	DADB	DANB	Load		Desand	Capacity	Load	Load	Demand	Capacity	
Hour		(F)	(Ton)	(Inn)	(FR)	(Ton-Hr)	(Ten)	(Ten)	(kN)	(Ton-Hr)	
1100:	V: 1	(, ,	(:011)	(,,,,	( , , ,	(70	(12)	,	• • • •		
1	70.1	65.3	150.5	885.0	828.4	2,347	150.5				
2	68.2	63.5	115.6	885.0	815.2	3,114	115.6	885.0		3,114	
3	66.6	62.2	88.6	885.0	807.6	3,908	88.5	885.0		3,908	
4	65.4	61.1	72.3	885.0	8.008	4,718	72.3	885.0		4,718	
5	64.6	60.7	101.5	387.6	333.0	5,000	101.5	387.6			
6	64.4	60.7	175.5	175.5	160.7	5,000	175.5				
7	54.9	61.2	173.0	173.0	160.7	5,000	173.0			-	
8	66.3	61.6	180.0	180.0	164.2	5,000	180.0				
9	68.5	62.5	178.0	178.0	165.2	5,000	178.0			5,000	
10	71.4	63.6	250.6	250.6	197.4	5,000	250.6				
11	74.5	65.1	396.0	396.0	267.7	5,000	396.0			5,000	
12	77.6	66.8	504.8	0.0	0.0	4,491	504.8			4,491	
13	80.5	68.2	495.1		0.0	3,993	495.1	0.0			
14	82.7	69.7	525.9	0.0	0.0	3,464		0.0			
15	84.2	70.7			0.0						
16	84.6	70.5			0.0						
17	84.4	70.4	668.2	0.0	0.0		668.2			1,613	
18	83.6	70.7	640.3	640.3	422.7	1,613			422.7		
19	82.4	70.7		496.1	338.9	1,613	496.1			1,613	
20	80.8	71.9				1,613	476.3			1,613	
21	78.9	72.4	433.7			1,613	433.7			1,613	
22	76.8	71.1	330.5			1,613	330.5			1,613	
23	74.5					1,613	243.3			1,613	
24	72.2	67.2	198.3	198.3	183,1	1,613	198.3	198.3	183.1	1,613	

---- BUILDING COOLING DEMANDS AND THERMAL STORAGE----

### September

			Design					
	Design		Cooling	Chiller	Chiller	Storage		
	DADB	DAMB	Load	Load	Demand	Capacity		
Hour	(F)	<b>(</b> F)	(Ton)	(Ton)	(kW)	(Ton-Hr)		
1	64.3	60.7	76.6	885.0	798.1	2,421		
2	63.3	59.8	60.2	895.0	792.6	3,243		
3	62.4	59.2	48.1	885.0	789.0	4,078		
4	61.8	58.5	35.4	885.0	784.9	4,924		
5	61.6	58.3	42.2	122.1	166.6	5,000		
6	62.0	58.7	54.3	54.3	64.5	5,000		
7	63.1	59.8	142.1	142.1	146.6	5,000		
8	64.9	61.3	146.5	146.5	151.0	5,000		
9	67.5	62.3	207.6	207.6	176.6	5,000		
10	70.6	63.4	305.6	305.6	220.8	5,000		
11	74.0	65.1	491.7	491.7	315.7	5,000		
12	77.3	66.6	611.3	0.0	0.0	4,385		
13	79.7	68.1	579.7	0.0	0.0	3,801		
14	81.3	68.9	596.3	0.0	0.0	3,202		
15	81.9	69.3	623.8	0.0	0.0	2,576		
16	81.3	68.8	684.1	0.0	0.0	1,890		
17	79.9	68.2	694.6	0.0	0.0	1,194		
18	77.7	67.0	653.5	653.5	414.3	1,194		
19	75.0	66.9	506.2	506.2	330.1	1,194		
20	72.4	66.6	369.5	369.5	259.5	1,194		
21	70.2	65.3	283.2	283.2	215.8	1,194		
22	68.1	63.7	169.8	169.8	164.3	1,194		
23	66.5	62.5	112.6	112.6	138.7	1,194		
24	65.3	61.6	96.5	96.5	117.8	1,194		

			Weekday				Saturday			
	Typical		Cooling	Chiller	Chiller	Storage	Cooling	Chiller	Chiller	Storage
	DADE	DAME	Load	Load	Demand	Capacity	Load	Load	Demand	Capacity
Hour	(F)	{F}	(Ton)	(Ton)	(k¥)	(Ton-Hr)	(Ton)	(Ton)	(kW)	(Ton-Hr)
1	63.9	61.5	68.5	885.0	803.2	2,009	74.8	885.0	803.2	2,973
2	62.0	59.7	47.6	885.0	792.0	2,845	48.1	885.0	792.0	3,808
3	60.4	58.4	26.6	885.0	784.3	3,701	26.6	885.0	784.3	4,663
4	59.2	57.1	15.4	885.0	777.0	4,568	15.4	356.0	308.3	5,000
5	58.4	56.3	19.2	455.2	378.5	5,000	19.2	0.0	0.0	5,000
6	58.2	56.1	24.3	24.3	28.9	5,000	24.3	24.3	28.9	5,000
7	58.7	56.7	8.4	0.0	0.0	5,000	8.4	0.0	0.0	5,000
8	60.1	57.9	87.6	87.6	104.0	5,000	87.6	87.6	104.0	5,000
9	62.4	58.6	79.2	79.2	94.1	5,000	79.2	79.2	94.1	5,000
10	65.2	59.6	142.2	142.2	145.6	5,000	142.9	142.9	148.8	5,000
11	58.3	61.1	275.3	275.3	201.5	5,000	275.3	275.3	201.8	5,000
12	71.5	62.7	415.0	0.0	0.0	4,581	415.0	0.0	0.0	4,581
13	74.3	64.6	413.9	0.0	0.0	4,163	414.3	0.0	0.0	4,163

Trane Air Conditioning Economics By: C.D.S. MARKETINS

COLD THERMAL STORAGE - ALTERNATIVE 2 B HOUR ICE BUILD, 10 HOUR CHILLER RUN

								•		
				#e	ekday			Sa	turday	
	Ty	pical				Storage				
	DADE	DAWE		Load	Desand	Capacity	Load	Load	Demand	Capacity
Hour	(F)				(88)	(Ton-Hr)	(Ton)	(Top)	(kW)	(Inn-Hr)
	. ,	. ,	(,,,,,	( ,	(80)	(	( , ,	( , ,	( /	(101. 111;
14	76.6	66.0	456.6	0.0	0.0	3,703	456.6	0.0	0.0	3,703
15		67.1	465.5			3,235	465.5			3,235
16		67.5	514.5	0.0	0.0	2,718	514.5	0.0	0.0	2,718
17	78.2	67.9	550.9	0.0	0.0	2,165	550.9			2,165
18	77.5	68.0	499.0	499.0	330.4	2,165	499.0	499.0		2,165
19	76.3	69.3	379.7	379.7	272.7	2,165	379.7			2,165
20	74.7	70.0	348.0	348.0	259.0	2,165	348.0	348.0		2,165
21	72.7	69.0	290.0	290.0	228.3	2,165	290.0			2,165
22	70.6	67.3	190.0	190.0						2,165
						2,165				
23	68.3	65.4				2,165				2,165
24	66.1	63.6	104.2	104.2	130.2	2,165	104.2	104.2	130.2	2,165
				5	iunday				londay	
	īv	pical				Storage			•	
	DADE	DAMB				Capacity				Capacity
Hour		(F)				(Ton-Hr)			(kW)	, ,
			,		•			,		
1	63.9	61.5	74.8	885.0	803.2	2,973	74.8	885.0	803.2	2,973
2	62.0	59.7	48.1	885.0	792.0	3,808	48.1	885.0	792.0	3,808
3	60.4	59.4	26.6	885.0		4,663			784.3	4,663
4	59.2	57.1	15.4			5,000			308.6	5,000
5	58.4	56.3	19.2	0.0		5,000		0.0	0.0	5,000
Ŀ	58.2	56.1	24.3		28.9	5,000			28.9	5,000
7	58.7	56.7	8.4	0.0		5,000			0.0	5,000
8	60.1	57.9	87.6	87.6		5,000				5,000
9	62.4	58.6	79.2	79.2		5,000				5,000
10	65.2	59.6	142.9			5,000				
11	68.3	61.1	275.3			5,000				5,000
12	71.5	62.7	415.0	0.0		4,581			0.0	
13	74.3	64.6	414.3				414.3			
14	76.6	66.0	456.6			3,703				3,703
15		67.1	465.5			3,235				3,235
16	78.5	67.5	514.5	0.0		2,718				2,718
17	78.2	67.9	550.9	0.0	0.0	2,165				2,16
	77.5			499.0						
19	76.3	69.3	379.7			2,165	379.7			2,165
20	74.7	70.0			259.0					
21	72.7									
		69.0			228.3					
22	70.6	67.3			179.8					2,16
23	68.3	65.4	121.4		149.0		121.4			2,165
24	66.1	63.6	104.2	104.2	130.2	2,165	104.2	104.2	130.2	2,163

## ECO IH-3

---- BUILDING COOLING DEMANDS AND THERMAL STORAGE----

June

Des: DADR (F) 68.7 67.8 67.0 66.4	OAWB (F) 65.1 64.4 63.5	Cooling Load (Ton) 0.0	Chiller Load (Ton)	Chiller Demand (kW)	Storage Capacity (Ton-Hr)
(F) 68.7 67.8 67.0	(F) 65.1 64.4	(Ton) 0.0	(Ton)	(k#)	(Ton-Hr)
68.7 67.8 67.0	65.1 64.4	0.0			
67.8 67.0	64.4		0.0	0.0	
67.0		0.0		V . V	2,400
	A3.5		0.0	0.0	2,400
66.4	0010	0.0	0.0	0.0	2,400
	62.7	0.0	0.0	0.0	2,400
66.3	62.7	0.0	0.0	0.0	2,400
66.6	63.7	0.0	0.0	0.0	2,400
67.6	64.5	0.0	0.0	0.0	2,400
69.3	65.1	0.0	0.0	0.0	2,400
71.8	66.0	65.3	65.3	81.3	2,400
74.6	67.6	109.2	109.2	100.6	2,400
77.8	69.8	241.8	241.8	167.4	2,400
80.9	71.9	384.5	384.5	255.7	2,400
83.2	73.5	353.7	353.7	240.4	2,400
84.7	74.4	435.0	435.0	296.8	2,400
85.3	74.6	542.1	542.1	381.2	2,400
84.7	74.5	682.4	625.0	453.2	2,343
83.4	73.5	806.8	625.0	449.4	2,161
81.3	71.5	769.0	625.0	442.0	2,018
78.8	70.1	652.3	625.0	437.0	1,991
76.3	70.0	591.1	591.1	407.2	1,991
74.2	69.5	546.4	480.0	465.5	1,923
72.3	68.7	422.4	480.0	462.3	1,979
70.8	67.1	245.2	480.0	456.1	2,211
69.7	65.8	170.5	361.5	321.7	2,400
	66.6 67.6 69.3 71.8 74.6 77.8 80.9 83.2 84.7 85.3 84.7 85.3 74.2 72.3 70.8	66.6 63.7 67.6 64.5 69.3 65.1 71.8 66.0 74.6 67.6 77.8 69.8 80.9 71.9 83.2 73.5 84.7 74.4 85.3 74.6 84.7 74.5 83.4 73.5 81.3 71.5 78.8 70.1 76.3 70.0 74.2 69.5 72.3 68.7 70.8 67.1	66.6     63.7     0.0       67.6     64.5     0.0       69.3     65.1     0.0       71.8     66.0     65.3       74.6     67.6     109.2       77.8     69.8     241.8       80.9     71.9     384.5       83.2     73.5     353.7       84.7     74.4     435.0       85.3     74.6     542.1       84.7     74.5     682.4       83.4     73.5     806.8       81.3     71.5     768.0       78.8     70.1     652.3       76.3     70.0     591.1       74.2     69.5     546.4       72.3     68.7     422.4       70.8     67.1     246.2	66.6         63.7         0.0         0.0           67.6         64.5         0.0         0.0           69.3         65.1         0.0         0.0           71.8         66.0         65.3         65.3           74.6         67.6         109.2         109.2           77.8         69.8         241.8         241.8           80.9         71.9         384.5         384.5           83.2         73.5         353.7         353.7           84.7         74.4         435.0         435.0           85.3         74.6         542.1         542.1           84.7         74.5         682.4         625.0           83.4         73.5         806.8         625.0           78.8         70.1         652.3         625.0           78.8         70.1         652.3         625.0           76.3         70.0         591.1         591.1           74.2         69.5         546.4         480.0           70.8         67.1         246.2         480.0	66.6         63.7         0.0         0.0         0.0           67.6         64.5         0.0         0.0         0.0           69.3         65.1         0.0         0.0         0.0           71.8         66.0         65.3         65.3         81.3           74.6         67.6         109.2         109.2         100.6           77.8         69.8         241.8         241.8         167.4           80.9         71.9         384.5         384.5         255.7           83.2         73.5         353.7         353.7         240.4           84.7         74.4         435.0         435.0         296.8           85.3         74.6         542.1         542.1         381.2           84.7         74.5         682.4         625.0         453.2           83.4         73.5         806.8         625.0         449.4           81.3         71.5         768.0         625.0         442.0           78.8         70.1         652.3         625.0         437.0           76.3         70.0         591.1         591.1         407.2           74.2         69.5         546.4         <

		Weekday						Saturday				
	Typ	pical	Cooling	Chiller	Chiller	Storage	Cooling	Chiller	Chiller	Storage		
	DADB	DAME	Load	Load	Demand	Capacity	Load	Load	Demand	Capacity		
Hour	(F)	(F)	(Ton)	(Ton)	{}}	(Ton-Hr)	(Ten)	(Ton)	(k₩)	(Ton-Hr)		
1	67.6	65.3	119.5	119.5	102.3	2,400	125.9	125.9	105.0	2,400		
2	66.0	63.9	103.2	103.2	93.9	2,400	102.7	102.7	93.7	2,400		
3	64.6	62.4	79.4	79.4	83.1	2,400	79.5	79.5	83.1	2,400		
4	63.7	61.3	65.3	65.3	1 76.8	2,400	65.3	65.3	76.8	2,400		
<b>E</b>	63.0	60.8	69.4	69.4	77.8	2,400	69.4	69.4	77.8	2,400		
é	62.8	61.2	153.4	153.4	111.4	2,400	153.5	153.5	111.4	2,400		
7	63.4	61.7	195.5	195.5	130.6	2,400	195.5	195.5	130.5	2,400		
8	65.1	62.3	185.3	185.3	126.9	2,400	185.6	185.6	127.1	2,400		
Ç	67.E	63.3	220.8	220.8	145.1	2,400	220.8	220.8	145.1	2,400		
10	70.7	65.2	286.9	286.9	182.1	2,400	286.9	286.9	182.1	2,400		
11	74.0	67.5	432.3	432.3	276.9	2,400	432.3	432.3	275.9	2,400		
12	77.1	69.8	557.6	557.6	378.5	2,400	557.6	557.6	378.5	2,400		
13	79.6	71.6	535.2	535.2	365.9	2,400	535.2	535.2	365.9	2,400		

				Ne	ekday		Saturday			
	Ty	pical				Storage				
	DADB	DAMB		Load	Demand	Capacity	Load	Load	Demand	Canarity
Hour	(F)	(F)			(kW)	(Ten-Hr)	(Ton)	(Ion)	(FM)	(Ton-Hr)
							(,,,,,	(,,,,	(30)	( ron m ;
14	81.3	72.7	534.2	534.2	368.5	2,400	534.2	534.2	368.5	2,400
15	81.8	72.8	561.4	561.4	391.4	2,400	561.4			2,400
16	81.6	73.1	609.6	609.6	434.2	2,400	609.6	609.6	434.2	2,400
17	81.0	72.7	678.8	625.0	446.4	2,346	678.8	625.0		2,346
18	80.0	71.6	665.1	625.0	442.4	2,306	665.1	625.0	442.4	2,306
19	78.7	71.3	542.0	542.0	370.5	2,306	542.0			2,306
20	77.1	72.0	496.4	496.4	336.3	2,306	496.4			2,306
21	75.3	71.8	448.1	480.0	474.9	2,336				2,336
22	73.3	71.0	338.5	404.0	383.0	2,400				2,400
23	71.3	68.9	227.4	227.4		2,400				2,400
24	69.4	66.8	158.1	158.1	121.2	2,400			121.2	2,400
						2,700	10011	20011	*****	2,000
				S	unday			}	onday	
	Ty	pical	Cooling	Chiller	Chiller	Storage	Cooling	Chiller	Chiller	Storage
	DADB	BAMB	Load	Load	Demand	Capacity	Load	Load	Demand	Capacity
Hour	(F)	(F)				(Ton-Hr)				
1		65.3	125.9		105.0	2,400				
2	66.0	63.9	102.7	102.7		2,400				2,400
3		62.4	79.5	79.5	83.1	2,400		79.5	83.1	2,400
4	63.7	61.3	65.3	65.3		2,400	65.3	65.3	76.8	
5	63.0	60.8	69.4	69.4		2,400	69.4	69.4	77.8	
6	62.8	61.2	153.5	153.5	111.4	2,400	153.5			
7	63.4	61.7	195.5	195.5	130.6	2,400	195.5			
8	65.1	62.3	185.6	185.6	127.1	2,400	185.6			2,400
9	67.6	63.3	220.8	220.8	145.1	2,400	220.8		145.1	2,400
10	70.7	65.2	286.9	286.9		2,400	288.9			2,400
11	74.0	67.5	432.3	432.3	276.9	2,400	432.3			
12	77.1	69.8	557.6	557.6	378.5	2,400				
13	79.6	71.6	535.2	535.2		2,400	535.2	535.2	365.9	2,400
14		72.7	534.2	534.2		2,400		534.2	368.5	2,400
15	81.8	72.8	561.4		391.4	2,400		561.4	391.4	2,400
16	81.6	73.1	609.6	609.6	434.2	2,400	609.6	609.6	434.2	2,400
17	81.0	72.7	678.8	625.0	446.4	2,346				2,346
18	80.0	71.6	665.1	625.0	442.4	2,306	665.1	625.0	442.4	2,306
19	78.7	71.3	542.0	542.0	370.5	2,306	542.0	542.0	370.5	
20	77.1	72.0	496.4	496.4	336.3	2,306	496.4	496.4	336.3	2,306
21	75.3	71.8	448.1	480.0	474.9	2,336	448.1	480.0	474.9	
22	73.3	71.0	338.5	404.0	383.0	2,400	338.5	404.0	383.0	2,400
23	71.3	68.9	227.4	227.4	158.2	2,400	227.4	227.4	158.2	2,400
24	69.4	8.36	158.1	158.1	121.2	2,400	158.1	158.1	121.2	2,400

---- BUILDING COOLING DEMANDS AND THERMAL STORAGE----

July

			Design						
	Desi	ign	Cooling	Chiller	Chiller	Storage			
	DADB	DAME	Load	Load	Demand	Capacity			
Hour	(F)	(F)	(Ton)	(Ton)	(kW)	(Ton-Hr)			
1	73.4	8.86	258.3	258.3	174.2	2,400			
2	72.3	67.9	205.7	206.7	146.1	2,400			
3	71.4	67.2	185.6	185.6	134.7	2,400			
4	70.7	67.0	180.9	180.9	132.1	2,400			
5	70.5	66.9	252.9	252.9	167.7	2,400			
6	71.0	67.4	326.9	326.9	209.2	2,400			
7	72.1	68.4	380.7	380.7	244.4	2,400			
8	74.1	69.3	401.4	401.4	260.2	2,400			
9	77.0	70.1	420.6	420.6	275.3	2,400			
10	80.4	71.4	494.4	494.4	333.0	2,400			
11	84.2	73.3	672.3	625.0	448.7	2,353			
12	87.8	75.5	775.6	625.0	457.0	2,202			
13	90.5	76.5	733.0	825.0	460.9	2,094			
14	92.3	76.8	763.3	625.0	462.1	1,956			
15	93.0	77.0	805.4	625.0	462.9	1,775			
16	92.3	76.7	891.8	625.0	461.7	1,509			
17	90.8	75.3	889.6	625.0	456.3	1,244			
18	88.3	74.2	850.2	625.0	452.1	1,009			
19	85.4	72.9	714.1	625.0	447.2	920			
20	82.4	73.4	680.5	625.0	449.1	854			
21	80.0	73.0	641.2	480.0	479.9	702			
22	77.7	72.3	559.5	480.0	477.0	622			
23	75.9	70.6	426.3	480.0	470.0	676			
24	74.6	69.4	280.2	480.0	465.1	875			

				#e	ekday		Saturday				
	Ty	pical	Cooling	Chiller	Chiller	Storage	Cooling	Chiller	Chiller	Storage	
	DADB	DANE	Load	Load	Demand	Capacity	Load	Load	Demand	Capacity	
Hour	(F)	(F)	(Ton)	(Ton)	(k₩)	(Ton-Hr)	(Ton)	(Ton)	(kW)	(Ton-Hr)	
1	74.3	71.0	259.7	480.0	471.6	1,094	265.3	480.0	471.6	1,936	
2	71.9	68.8	219.9	480.0	462.7	1,354	214.6	480.0	462.7	2,200	
3	69.9	67.0	167.1	480.0	455.7	1,665	167.3	369.2	333.0	2,400	
4	68.3	65.9	152.3	480.0	451.5	1,992	152.7	152.7	117.5	2,400	
5	67.4	65.2	203.0	480.0	448.8	2,267	203.1	203.1	139.8	2,400	
6	67.0	64.9	256.9	391.5	349.4	2,400	256.9	256.9	165.9	2,400	
7	67.5	65.3	274.1	274.1	175.6	2,400	274.2	274.2	175.6	2,400	
8	69.8	65.6	262.6	262.6	170.2	2,400	262.6	262.6	170.2	2,400	
9	70.9	65.7	248.7	248.7	163.2	2,400	248.7	248.7	163.2	2,400	
10	73.6	66.5	305.3	305.3	194.9	2,400	305.3	305.3	194.9	2,400	
11	76.7	67.9	454.0	454.0	293.2	2,400	454.0	454.0	293.2	2,400	
12	79.9	69.9	581.5	581.5	398.9	2,400	581.5	581.5	398.8	2,400	
13	83.0	71.3	563.2	563.2	388.0	2,400	563.2	563.2	398.0	2,400	

COLD THERMAL STORAGE - ALTERNATIVE 3 12 HOUR ICE BUILD, 12 HOUR CHILLER RUN

		Weekday					Saturday				
	Ty	pical	Cooling	Chiller	Chiller	Storage	Cooling	Chiller	Chiller	Storage	
	DADR	DANK	Load	Load	Demand	Capacity					
Hour	(F)	(F)	(Ton)	(Ton)	(kW)	(Ton-Hr)	(Ton)	(Ton)	(kW)		
								,			
14	85.7	72.5	597.7	597.7	421.5	2,400	597.7	597.7	421.5	2,400	
15	87.8	73.9	654.3	625.0	450.9	2,371	654.3	625.0		2,371	
16	89.1	75.3	737.3	625.0	456.3	2,258	737.3	625.0	456.3		
17	89.5	75.5	810.6	625.0	457.0					2,258	
	89.2		803.8			2,073	810.6	625.0	457.0	2,073	
18		76.2		625.0	459.7	1,894	803.8	625.0	459.7	1,894	
19	88.3	76.7	700.3	625.0	461.7	1,819	700.3	625.0	461.7	1,819	
20	86.7	78.6	684.0	625.0	469.2	1,760	684.0	625.0	469.2	1,760	
21	84.7	78.8	656.5	480.0	504.8	1,582	656.5	480.0	504.8	1,582	
22	82.3	78.0	549.7	480.0	501.3	1,511	549.7			1,511	
23	79.6	75.4	419.7	480.0	490.0	1,570	419.7	480.0	490.0	1,570	
24	76.9	73.0	325.9	480.0	479.9	1,723	325.9	480.0	479.9	1,723	
				5	iunday			<del>}</del>	londay		
	Ty	pical			•	Storage			Chiller		
	OADB	DAMB	Load	Load						•	
Hour	(F)	(F)	(Ton)			(Ton-Hr)					
11041	(, )	0.7	(100)	(1011)	( K III )	(10n m)	(1011)	1,507	1887	(10) 11)	
	74.3	71.0	265.3	480.0	471 /	1.07/	265.3	480.0	471.6	+ 07/	
1						1,936				1,936	
2	71.9	8.8	214.6	480.0		2,200	214.6	480.0		2,200	
3	69.9	67.0	167.3	369.2	333.0	2,400	167.3	369.2		2,400	
4	68.3	65.9	152.7	152.7	117.5	2,400	152.7	152.7		2,400	
5	67.4	65.2	203.1	203.1	139.8	2,400	203.1	203.1		2,400	
6	67.0	64.9	256.9	256.9	165.9	2,400	256.9	256.9		2,400	
7	67.5	65.3	274.2	274.2	175.6	2,400	274.2	274.2	175.6	2,400	
8	68.8	65.6	262.6	262.6	170.2	2,400	262.6	262.6	170.2	2,400	
9	70.9	65.7	248.7	248.7	163.2	2,400	248.7	248.7	163.2	2,400	
10	73.6	66.5	305.3	305.3	194.9	2,400	305.3	305.3	194.9	2,400	
11	75.7	67.9	454.0	454.0	293.2	2,400	454.0	454.0		2,400	
12	79.9	69.9	581.5	581.5	398.8	2,400	581.5	581.5		2,400	
13	83.0	71.3	563.2	563.2	388.0	2,400	563.2	563.2		2,400	
14	85.7	72.5	597.7	597.7		2,400	597.7			2,400	
15	87.8	73.9	654.3	625.0		2,371	654.3				
16	89.1	75.3	737.3	625.0		2,258	737.3	625.0		2,258	
17	89.5	75.5	810.6	625.0	457.0	2,073	810.6	625.0		2,073	
18		76.2	803.8		459.7						
						1,894			459.7		
19	88.3	76.7	700.3	625.0	461.7	1,819	700.3	625.0		1,819	
20	86.7	78.6	684.0	625.0	469.2	1,760	684.0	625.0		1,760	
21	84.7	78.8	656.5	480.0	504.8	1,582	656.5	480.0		1,582	
22	82.3	78.0	549.7	480.0	501.3	1,511	549.7	480.0		1,511	
23	79.6	75.4	419.7	480.0	490.0	1,570	419.7	480.0		1,570	
24	76.9	73.0	325.9	480.0	479.9	1,723	325.9	480.0	479.9	1,723	

---- BUILDING COOLING DEMANDS AND THERMAL STORAGE----

August

			Design								
	Desi	ign	Cooling		-	Storage					
	DADE	DAMB	Load	Load	Demand	Capacity					
Hour	(F)	(F)	(Ton)	(Ton)	(kW)	(Ton-Hr)					
1	70.5	64.5	164.0	480.0	446.2	2,037					
2	69.5	63.5	133.5	480.0	442.6	2,382					
3	68.7	63.0	120.1	139.7	137.7	2,400					
4	68.1	62.4	107.0	107.0	93.7	2,400					
5	67.9	62.6	162.3	162.3	117.2	2,400					
6	68.3	63.2	240.7	240.7	154.5	2,400					
7	69.3	64.1	261.5	261.5	166.6	2,400					
8	71.1	64.9	292.4	292.4	184.4	2,400					
9	73.7	66.1	328.4	328.4	207.1	2,400					
10	76.8	67.2	406.9	406.9	258.9	2,400					
11	80.2	68.9	583.6	583.6	397.2	2,400					
12	83.4	70.6	695.3	625.0	438.8	2,330					
13	85.8	71.5	664.3	625.0	442.0	2,290					
14	87.5	72.5	698.6	625.0	445.7	2,217					
15	88.1	72.7	727.3	625.0	446.4	2,114					
16	87.5	71.7	794.2	625.0	442.8	1,945					
17	86.0	70.6	806.4	625.0	438.8	1,764					
18	83.8	69.7	758.7	625.0	435.6	1,630					
19	81.2	68.5	598.2	598.2	408.3	1,630					
20	78.6	68.7	545.2	545.2	365.0	1,630					
21	76.4	8.84	454.4	480.0	462.7	1,654					
22	74.3	67.6	321.1	490.0	458.0	1,817					
23	72.7	66.4	220.8	480.0	453.4	2,070					
24	71.5	65.3	194.9	480.0	449.2	2,353					

				Ne	ekday		Saturday					
	Ty	pical	Cooling	Chiller	Chiller	Storage	Cooling	Chiller	Chiller	Storage		
	DADB	DAKE	Load	Load	Demand	Dapacity	Load	Load	Demand	Capacity		
Hour	(F)	<b>(F)</b>	(Ton)	(Ton)	(kW)	(Ton-Hr)	(Ton)	(Ten)	(k₩)	(Ton-Hr)		
1	70.1	65.3	145.1	193.8	178.9	2,400	150.5	150.5	115.7	2,400		
2	68.2	63.5	116.3	116.3	98.8	2,400	115.6	115.6	98.5	2,400		
3	66.6	62.2	88.4	88.4	86.3	2,400	88.6	88.6	86.3	2,400		
4	65.4	61.1	72.4	72.4	79.2	2,400	72.3	72.3	79.2	2,400		
5	64.6	60.7	101.2	101.2	1.89.5	2,400	101.5	101.5	89.7	2,400		
6	64.4	50.7	175.6	175.6	120.2	2,400	175.5	175.5	120.2	2,400		
7	64.7	61.2	173.0	173.0	119.8	2,400	173.0	173.0	119.9	2,400		
8	66.3	61.6	179.8	179.8	123.4	2,400	180.0	130.0	123.5	2,400		
9	68.5	62.5	178.1	178.1	124.0	2,400	178.0	178.0	124.0	2,400		
10	71.4	63.6	250.5	250.5	160.1	2,400	250.6	250.6	160.2	2,400		
11	74.5	65.1	396.0	396.0	245.8	2,400	396.0	398.0	246.8	2,400		
12	77.6	55.9	504.8	504.8	327.7	2,400	504.8	504.8	327.7	2,400		
13	80.5	68.2	495.1	495.1	324.3	2,400	495.1	495.1	324.3	2,400		

Trane Air Conditioning Economics By: C.D.S. MARKETINE

				We	ekday		Saturday			
	Typ	pical	Cooling	Chiller	Chiller	Storage	Cooling	Chiller	Chiller	Storage
	DADB	DAMB	Load	Load	Demand	Dapacity	Load	Load	Demand	Capacity
Hour	(F)	(F)		(Ton)		(Ton-Hr)			(k¥)	
14	82.7	69.7	525.9	525.9	352.5	2,400	525.9	525.9	352.5	2,400
15	84.2	70.7	562.3	562.3	385.3	2,400	562.3	562.3	385.3	2,400
16	84.6	70.5	612.6	612.6	427.5	2,400	612.6	612.6	427.5	2,400
17	84.4	70.4	668.2	625.0	438.1	2,357	668.2	625.0		2,357
18	83.6	70.7	640.3	625.0	439.1	2,342	640.3	625.0		2,342
19	82.4	70.7	496.1	495.1	332.2	2,342	495.1	496.1	332.2	2,342
20	80.8	71.9	476.3	476.3	320.5	2,342	476.3	476.3	320.5	2,342
21	78.9	72.4	433.7	480.0	477.4	2,386	433.7	480.0		
22	76.8	71.1	330.5	346.5	323.6	2,400	330.5	346.5		2,400
23	74.5	69.3	243.3	243.3	167.2	2,400	243.3			2,400
24	72.2	67.2	198.3	198.3	140.8	2,400	198.3	198.3		2,400
				9	innday				londay	
	Tv	pical				Storage				Storage
	DADB	DANE	Load			Capacity	Load	Load	Desand	Capacity
Hour	(F)	(F)				(Ton-Hr)	(Ton)	(Ton)	(k₩)	(Ton-Hr)
	70.1	/ 5 7	1 E A E	150 5	115 7	2,400	150.5	150,5	115.7	2,400
1	70.1	65.3	150.5							2,400
2	68.2	63.5	115.6	115.6			115.6		86.3	2,400
3	66.6	62.2	88.6	88.6		2,400	88.6			2,400
4	65.4	61.1	72.3		79.2	2,400				2,400
5	64.5	60.7	101.5			2,400				2,400
6	64.4	60.7	175.5			2,400				2,400
7	64.9	61.2	173.0			2,400	173.0			2,400
В	66.3	61.6	180.0	180.0		2,400	180.0 178.0			2,400
9	68.5	62.5	178.0			2,400	250.6			2,400
10	71.4	63.6	250.6	250.6		2,400	395.0			2,400
11	74.5	65.1	396.0			2,400 2,400	504.8			2,400
12	77.6	8.66	504.8	504.8		2,400	495.1			2,400
13	80.5	68.2	495.1	495.1			525.9			
14	82.7	69.7	525.9			2,400				
15	84.2	70.7	562.3			2,400				2,400
16	84.6	70.5	612.6			2,400				2,357
17	84.4	70.4	668.2			2,357				
18	83.6	70.7				2,342	640.3			2,342
19	82.4	70.7				2,342	496.1			2,342
20	80.8	71.9				2,342	476.3			2,342
21	78.9	72.4	433.7				433.7			
22	76.8	71.1	330.5			2,400				2,400
23	74.5	69.3				2,400				2,400
24	72.2	67.2	198.3	198.3	140.8	2,400	198.3	198.3	140.8	2,400

#### ---- BUILDING COOLING DEMANDS AND THERMAL STORAGE----

#### September

			Design						
	Desi	ign	Cooling	Chiller	Chiller	Storage			
	DADR	DAMB	Load	Load	Demand	Capacity			
Hour	(F)	(F)	(Ton)	(Ton)	(kW)	(Ton-Hr)			
			_						
1	64.3	60.7	76.6	76.6	80.3	2,400			
2	63.3	59.8	60.2	50.2	71.7	2,400			
3	62.4	59.2	48.1	48.1	57.2	2,400			
4	61.8	58.5	35.4	35.4	42.0	2,400			
5	61.6	58.3	42.2	42.2	50.2	2,400			
é	62.0	58.7	54.3	54.3	64.5	2,400			
7	63.1	59.8	142.1	142.1	105.1	2,400			
8	64.9	61.3	146.5	145.5	103.6	2,400			
9	67.5	62.3	207.6	207.6	137:2	2,400			
10	70.6	63.4	305.6	305.6	189.9	2,400			
11	74.0	65.1	491.7	491.7	313.3	2,400			
12	77.3	66.6	611.3	611.3	413.2	2,400			
13	79.7	48.1	579.7	579.7	391.3	2,400			
14	81.3	68.9	596.3	596.3	408.0	2,400			
15	81.9	69.3	623.8	623.8	433.1	2,400			
16	81.3	68.8	684.1	625.0	432.4	2,341			
17	79.9	68.2	694.6	625.0	430.3	2,271			
18	77.7	67.0	653.5	625.0	426.3	2,243			
19	75.0	66.9	506.2	506.2	329.1	2,243			
20	72.4	66.6	369.5	369.5	233.2	2,243			
21	70.2	65.3	283.2	442.2	405.4	2,400			
22	68.1	63.7	169.8	169.8	122.1	2,400			
23	66.5	62.5	112.6	112.6	96.1	2,400			
24	65.3	61.6	95.5	96.5	88.7	2,400			

				¥e	Weekday			Saturday			
	Ty	pical	Cooling	Chiller	Chiller	Storage	Cooling	Chiller	Chiller	Storage	
	DADB	DANB	Load	Load	Demand	Capacity	Load	Load	Demand	Capacity	
Hour	(F)	(F)	(Ton)	(Ton)	(k#)	(Ton-Hr)	(Ton)	(Ton)	(kW)	(Ton-Hr)	
1	63.9	61.5	68.5	68.5	78.2	2,400	74.8	74.8	80.5	2,400	
2	62.0	59.7	47.6	47.6	56.7	2,400	48.1	48.1	57.3	2,400	
3	60.4	58.4	26.6	26.6	31.6	2,400	26.6	25.6	31.6	2,400	
4	59.2	57.1	15.4	15.4	18.3	2,400	15.4	15.4	18.3	2,400	
5	58.4	56.3	19.2	19.2	, 22.8	2,400	19.2	19.2	22.8	2,400	
6	58.2	56.1	24.3	24.3	28.9	2,400	24.3	24.3	28.9	2,400	
7	58.7	56.7	8.4	0.0	0.0	2,400	8.4	0.0	0.0	2,400	
8	60.1	57.9	87.6	87.6	83.5	2.400	87.6	87.6	83.5	2,400	
9	57.4	58.6	79.2	79.2	80.4	2,400	79.2	79.2	80.4	2,400	
10	65.2	59.6	142.2	142.2	105.1	2,400	142.9	142.9	105.4	2,400	
11	68.3	61.1	275.3	275.3	168.2	2,400	275.3	275.3	168.2	2,400	
12	71.5	62.7	415.0	415.0	253.7	2,400	415.0	415.0	253.8	2,400	
13	74.3	64.E	413.9	413.9	257.4	2,400	414.3	414.3	257.6	2,400	

Trane Air Conditioning Economics By: C.D.S. MARKETING

20     74.7     70.0     348.0     348.0     228.0     2,400     348.0     348.0     228.0     2,400       21     72.7     69.0     290.0     290.0     192.0     2,400     290.0     290.0     192.0     2,400       22     70.6     67.3     190.0     190.0     136.9     2,400     190.0     190.0     136.9     2,400       23     68.3     65.4     121.4     121.4     103.2     2,400     121.4     121.4     103.2     2,400					No.	-1. d					
Hour   (F)   (F)   (Ton)   (Ton)   (kW)   (Ton-Hr)   (Ton)   (Ton)   (kW)   (Ton-Hr)		7	1	Carlina	Chi 21	PK087	Ci	Conline	Chiller	Chilles	Cinesno
Hour   (F)   (F)   (Ton)   (Ton)   (kW)   (Ton-Hr)   (Ton)   (Ton)   (kW)   (Ton-Hr)		175	DAND	rooting	Laitter	Cullist	Carage	Locations	Curries	Damand	Caracity
14 76.6 66.0 458.6 456.6 290.2 2,400 458.6 456.5 290.1 2,400 15 78.0 67.1 465.5 465.5 299.4 2,400 455.5 465.5 299.4 2,400 16 78.5 67.5 514.5 514.5 337.2 2,400 514.5 514.5 337.2 2,400 17 78.2 67.9 550.9 550.9 367.1 2,400 590.9 550.9 367.1 2,400 18 77.5 68.0 499.0 499.0 326.7 2,400 499.0 499.0 326.7 2,400 19 76.3 69.3 379.7 379.7 245.9 2,400 379.7 379.7 245.9 2,400 20 74.7 70.0 348.0 348.0 228.0 2,400 379.7 379.7 245.9 2,400 21 72.7 69.0 290.0 290.0 192.0 2,400 290.0 192.0 2,400 22 76.6 67.3 190.0 190.0 136.5 2,400 190.0 190.0 136.9 2,400 23 68.3 65.4 121.4 121.4 103.2 2,400 190.0 190.0 136.9 2,400 24 66.1 63.6 104.2 104.2 93.9 2,400 104.2 104.2 93.9 2,400 24 66.1 63.6 104.2 104.2 93.9 2,400 104.2 104.2 93.9 2,400 25 62.0 59.7 48.1 46.1 57.3 2,400 104.2 104.2 93.9 2,400 2 62.0 59.7 48.1 46.1 57.3 2,400 104.2 104.2 93.9 2,400 2 62.0 59.7 48.1 46.1 57.3 2,400 104.2 104.2 93.9 2,400 2 65.2 56.1 24.3 24.3 28.9 2,400 15.4 15.4 18.3 2,400 2 65.2 56.1 24.3 24.3 28.9 2,400 15.4 15.4 18.3 2,400 2 65.2 56.1 24.3 24.3 28.9 2,400 15.4 15.4 18.3 2,400 2 65.2 56.1 24.3 24.3 28.9 2,400 19.2 19.2 22.9 2,400 2 65.2 56.1 24.3 24.3 28.9 2,400 19.2 19.2 29.9 2,400 2 65.2 56.1 24.3 24.3 28.9 2,400 19.2 19.2 29.2 2,400 2 65.2 56.1 24.3 24.3 28.9 2,400 19.2 19.2 29.2 2,400 2 65.2 56.1 24.3 24.3 28.9 2,400 19.2 19.2 29.2 2,400 2 65.2 56.1 24.3 24.3 28.9 2,400 14.2 19.2 29.2 2,400 2 65.2 56.1 24.3 24.3 28.9 2,400 14.2 19.2 29.2 29.0 2,400 2 65.2 56.1 24.3 24.3 28.9 2,400 14.2 19.2 29.2 29.0 2,400 2 65.2 56.1 24.3 24.3 28.9 2,400 14.2 19.2 29.2 29.0 2,400 2 65.2 56.1 24.5 36.6 26.6 31.6 2,400 38.4 6.0 0.0 2,400 3 66.1 57.9 87.6 87.6 87.6 87.6 87.5 87.6 87.6 87.6 87.5 29.4 2,400 2 67.4 58.6 79.9 57.2 79.2 80.4 2,400 79.2 79.2 80.4 2,400 2 67.4 58.6 79.9 57.2 79.2 80.4 2,400 79.2 79.2 80.4 2,400 2 67.4 58.6 79.9 57.2 79.2 80.4 2,400 79.2 79.2 80.4 2,400 2 77.5 69.0 49.0 499.0 326.7 2,400 348.0 348.0 228.0 2,400 2 77.5 69.0 290.0 190.0 136.9 2,400 348.0 348.0 228.0 2,400 2 77.7 69.0 290.0 190.0 136.9 2,400 348.0 348.0 228.0 2,400 2 77.7 69.0				17	(Top)	(にお)	(Ten-be)	(Inc.)	(Tes)	1501	(Inn-Mr)
15   78.0   67.1   465.5   465.5   299.4   2,400   465.5   465.5   299.4   2,400   16   78.5   67.5   514.5   514.5   514.5   537.2   2,400   514.5   514.5   537.2   2,400   18   77.5   68.0   479.0   479.0   326.7   2,400   479.0   479.0   326.7   2,400   19   76.3   69.3   379.7   379.7   245.9   2,400   379.7   379.7   245.9   2,400   274.7   70.0   348.0   348.0   228.0   2,400   348.0   348.0   228.0   2,400   270.0   270.0   192.0   2,400   270.0   270.0   192.0   2,400   270.0   270.0   192.0   2,400   270.0   270.0   192.0   2,400   270.0   270.0   192.0   2,400   270.0   270.0   192.0   2,400   270.0   270.0   192.0   2,400   270.0   270.0   192.0   2,400   270.0   270.0   192.0   2,400   270.0   270.0   192.0   2,400   270.0   270.0   270.0   192.0   2,400   270.0   270.0   270.0   192.0   2,400   270.0   2	nour	(1)	171	(10n)	(108)	( * # )	(1087-07)	(100)	(1011)	( K# )	(1011-01)
16	14	76.6	66.0	456.6					455.6	290.1	2,400
16 78.5 67.5 514.5 514.5 514.5 537.2 2,400 514.5 514.5 337.2 2,400 17 78.2 67.9 550.9 550.9 367.1 2,400 18 77.5 68.0 499.0 499.0 326.7 2,400 499.0 326.7 2,400 19 76.3 69.3 379.7 379.7 245.9 2,400 379.7 379.7 245.9 2,400 20 74.7 70.0 346.0 348.0 228.0 2,400 348.0 328.0 228.0 2,400 21 72.7 69.0 290.0 290.0 192.0 2,400 290.0 190.0 190.0 136.9 2,400 22 70.6 67.3 190.0 190.0 136.9 2,400 190.0 190.0 136.9 2,400 23 68.3 65.4 121.4 121.4 103.2 2,400 121.4 121.4 103.2 2,400 24 66.1 63.6 104.2 104.2 93.9 2,400 104.2 93.9 2,400 25 70.6 67.3 190.0 190.0 136.9 2,400 104.2 104.2 93.9 2,400 26 65.1 65.6 104.2 104.2 93.9 2,400 104.2 104.2 93.9 2,400 27 70.6 67.3 190.0 190.0 106.1 106.2 104.2 93.9 2,400 28 68.3 65.4 121.4 121.4 103.2 2,400 104.2 104.2 93.9 2,400 29 70.6 104.2 104.2 93.9 2,400 104.2 104.2 93.9 2,400 20 70.6 67.3 190.0 106.1 106.1 106.2 104.2 93.9 2,400 20 70.6 67.3 104.2 104.2 93.9 2,400 104.2 104.2 93.9 2,400 20 80.0 104.2 104.2 93.9 2,400 20 80.0 104.2 104.2 93.9 2,400 20 70.6 104.2 104.2 104.2 93.9 2,400 20 70.6 104.2 104.2 104.2 104.2 93.9 2,400 20 70.6 104.2	15	78.0	67.1	465.5	465.5	299.4	2,400	465.5	465.5	299.4	2,400
18	16	78.5	67.5		514.5	337.2	2.400	514.5	514.5	<b>3</b> 37.2	2,400
18	17	78.2	67.9	550.9		367.1	2,400	550.9	550.9	367.1	2,400
Typical   Cooling Chiller   Chiller   Storage   Cooling Chiller   Chiller   Storage   Capacity	18	77.5	68.0	499.0	499.0	326.7	2,400	499.0	499.0	326.7	2,400
23 68.3 65.4 121.4 121.4 103.2 2,400 121.4 121.4 103.2 2,400 24 66.1 63.6 104.2 104.2 93.9 2,400 104.2 104.2 93.9 2,400	19	76.3	69.3	379.7	379.7	245.9	2,400	379.7	379.7	245.9	2,400
23 68.3 65.4 121.4 121.4 103.2 2,400 121.4 121.4 103.2 2,400 24 66.1 63.6 104.2 104.2 93.9 2,400 104.2 104.2 93.9 2,400	20	74.7	70.0	348.0	348.0	228.0	2,400	348.0	348.0	228.0	2,400
23 68.3 65.4 121.4 121.4 103.2 2,400 121.4 121.4 103.2 2,400 24 66.1 63.6 104.2 104.2 93.9 2,400 104.2 104.2 93.9 2,400	21	72.7	69.0	290.0	290.0	192.0	2,400	290.0	290.0	192.0	2,400
23 68.3 65.4 121.4 121.4 103.2 2,400 121.4 121.4 103.2 2,400 24 66.1 63.6 104.2 104.2 93.9 2,400 104.2 104.2 93.9 2,400	22	76.6	67.3	190.0	190.0	136.9	2,400	190.0	190.0	136.9	2,400
Typical   Cooling   Chiller   Chiller   Storage   Cooling   Chiller   Chiller   Chiller   Chiller   Capacity   Load   Load   Capacity   Capac		48.3	65.4	121.4	121.4	103.2	2,400	121.4	121.4	103.2	2,400
Typical DAMB   DAMB   Load   Load   Deward   Capacity   Load   Load   Deward   Capacity   Load   Load   Deward   Capacity   Capaci		66.1	63.6	104.2	104.2	93.9	2,400	104.2	104.2	93.9	2,400
Typical DAMB   DAMB   Load   Load   Deward   Capacity   Load   Load   Deward   Capacity   Load   Load   Deward   Capacity   Capaci					5	unday			<del>}</del>	londay	
Hour		Ty	pical	Engling	Chiller	Chiller	Storage	Cooling	Chiller	Chiller	Storage
1       63.9       61.5       74.8       74.8       80.5       2,400       74.8       74.8       80.5       2,400         2       62.0       59.7       48.1       48.1       57.3       2,400       48.1       48.1       57.3       2,400         3       60.4       58.4       26.6       26.6       31.6       2,400       26.6       26.6       31.6       2,400         4       59.2       57.1       15.4       15.4       18.3       2,400       15.4       15.4       18.3       2,400         5       58.4       56.3       19.2       19.2       22.8       2,400       19.2       19.2       22.8       2,400         6       58.2       56.1       24.3       24.3       28.9       2,400       24.3       24.3       28.9       2,400         7       58.7       56.7       8.4       0.0       0.0       2,400       8.4       0.0       0.0       2,400       8.4       0.0       0.0       2,400         9       62.4       58.6       79.2       79.2       80.4       2,400       79.2       79.2       80.4       2,400         10       65.2       5			DAWE	Load	Load	Demand	Capacity	Load	Load	Demand	Capacity
1       63.9       61.5       74.8       74.8       80.5       2,400       74.8       74.8       96.5       2,400         2       62.0       59.7       48.1       48.1       57.3       2,400       48.1       48.1       57.3       2,400         3       60.4       58.4       26.6       26.6       31.6       2,400       26.6       26.6       31.6       2,400         4       59.2       57.1       15.4       15.4       18.3       2,400       15.4       15.4       18.3       2,400         5       58.4       56.3       19.2       19.2       22.8       2,400       19.2       19.2       22.8       2,400         6       58.2       56.1       24.3       24.3       28.9       2,400       24.3       24.3       28.9       2,400         7       58.7       56.7       8.4       0.0       0.0       2,400       8.4       0.0       0.0       2,400         8       60.1       57.9       87.6       87.6       83.5       2,400       87.6       87.6       83.5       2,400         9       62.4       58.6       79.2       79.2       80.4	Hour	(F)	(F)	(Ton)	(Ton)	(k¥)	(Ton-Hr)	(Ton)	(Ton)	(kW)	(Ton-Hr)
3       60.4       58.4       26.6       26.6       31.6       2,400       26.6       26.6       31.6       2,400         4       59.2       57.1       15.4       15.4       18.3       2,400       15.4       15.4       18.3       2,400         5       58.4       56.3       19.2       19.2       22.8       2,400       19.2       19.2       22.8       2,400         6       58.2       56.1       24.3       24.3       28.9       2,400       24.3       24.3       28.9       2,400         7       58.7       56.7       8.4       0.0       0.0       0.2,400       8.4       0.0       0.0       2,400         8       60.1       57.9       87.6       87.6       83.5       2,400       87.6       87.6       83.5       2,400         9       62.4       58.6       79.2       79.2       80.4       2,400       79.2       79.2       80.4       2,400         10       65.2       59.6       142.9       105.4       2,400       79.2       79.2       80.4       2,400         11       68.3       61.1       275.3       275.3       168.2       2,400	t	L7 0	41.5	74.9	7£ 9	8ú 5	2 400	74.8	74.R	80.5	2.400
3       60.4       58.4       26.6       26.6       31.6       2,400       26.6       26.6       31.6       2,400         4       59.2       57.1       15.4       15.4       18.3       2,400       15.4       15.4       18.3       2,400         5       58.4       56.3       19.2       19.2       22.8       2,400       19.2       19.2       22.8       2,400         6       58.2       56.1       24.3       24.3       28.9       2,400       24.3       24.3       28.9       2,400         7       58.7       56.7       8.4       0.0       0.0       0.2,400       8.4       0.0       0.0       2,400         8       60.1       57.9       87.6       87.6       83.5       2,400       87.6       87.6       83.5       2,400         9       62.4       58.6       79.2       79.2       80.4       2,400       79.2       79.2       80.4       2,400         10       65.2       59.6       142.9       105.4       2,400       79.2       79.2       80.4       2,400         11       68.3       61.1       275.3       275.3       168.2       2,400				A9 1	A9 1	57 3	7.400	48.1	48.1	57.3	2.400
6       58.2       58.1       24.3       24.3       28.9       2,400       24.3       24.3       28.9       2,400         7       58.7       56.7       8.4       0.0       0.0       2,400       8.4       0.0       0.0       2,400         8       60.1       57.9       87.6       87.6       83.5       2,400       79.2       79.2       80.4       2,400         9       62.4       58.6       79.2       79.2       80.4       2,400       79.2       79.2       80.4       2,400         10       65.2       59.6       142.9       162.9       105.4       2,400       142.9       142.9       105.4       2,400         11       68.3       61.1       275.3       275.3       168.2       2,400       275.3       275.3       168.2       2,400         12       71.5       62.7       415.0       415.0       253.8       2,400       415.0       415.0       253.8       2,400         13       74.3       64.6       414.3       274.0       2,400       414.3       414.3       257.6       2,400         14       76.6       66.0       456.6       456.6       290.1					26.6	31.6	2,400	25.6	76.6	31.6	
6       58.2       58.1       24.3       24.3       28.9       2,400       24.3       24.3       28.9       2,400         7       58.7       56.7       8.4       0.0       0.0       2,400       8.4       0.0       0.0       2,400         8       60.1       57.9       87.6       87.6       83.5       2,400       79.2       79.2       80.4       2,400         9       62.4       58.6       79.2       79.2       80.4       2,400       79.2       79.2       80.4       2,400         10       65.2       59.6       142.9       162.9       105.4       2,400       142.9       142.9       105.4       2,400         11       68.3       61.1       275.3       275.3       168.2       2,400       275.3       275.3       168.2       2,400         12       71.5       62.7       415.0       415.0       253.8       2,400       415.0       415.0       253.8       2,400         13       74.3       64.6       414.3       274.0       2,400       414.3       414.3       257.6       2,400         14       76.6       66.0       456.6       456.6       290.1					15. A	18 3	2,400	15.4	15.4	18.3	2.400
6       58.2       58.1       24.3       24.3       28.9       2,400       24.3       24.3       28.9       2,400         7       58.7       56.7       8.4       0.0       0.0       2,400       8.4       0.0       0.0       2,400         8       60.1       57.9       87.6       87.6       83.5       2,400       79.2       79.2       80.4       2,400         9       62.4       58.6       79.2       79.2       80.4       2,400       79.2       79.2       80.4       2,400         10       65.2       59.6       142.9       162.9       105.4       2,400       142.9       142.9       105.4       2,400         11       68.3       61.1       275.3       275.3       168.2       2,400       275.3       275.3       168.2       2,400         12       71.5       62.7       415.0       415.0       253.8       2,400       415.0       415.0       253.8       2,400         13       74.3       64.6       414.3       274.0       2,400       414.3       414.3       257.6       2,400         14       76.6       66.0       456.6       456.6       290.1				19.7	19.7	22.8	2,400	19.2	19.2	22.8	2.400
8       60.1       57.9       87.6       87.6       83.5       2,400       87.6       87.6       83.5       2,400         9       62.4       58.6       79.2       79.2       80.4       2,400       79.2       79.2       80.4       2,400         10       65.2       59.6       142.9       142.9       105.4       2,400       142.9       142.9       105.4       2,400         11       68.3       61.1       275.3       275.3       168.2       2,400       275.3       275.3       168.2       2,400         12       71.5       62.7       415.0       415.0       253.8       2,400       415.0       415.0       253.8       2,400         13       74.3       64.6       414.3       414.3       257.6       2,400       414.3       414.3       257.6       2,400       414.3       414.3       257.6       2,400         14       76.6       66.0       456.6       456.6       290.1       2,400       456.6       456.6       290.1       2,400       456.6       290.1       2,400         15       78.0       67.1       465.5       337.2       2,400       456.6       456.6       299.					27.Z	22.0	2 400	24.3	24.3	28.9	2.400
8       60.1       57.9       87.6       87.6       83.5       2,400       87.6       87.6       83.5       2,400         9       62.4       58.6       79.2       79.2       80.4       2,400       79.2       79.2       80.4       2,400         10       65.2       59.6       142.9       142.9       105.4       2,400       142.9       142.9       105.4       2,400         11       68.3       61.1       275.3       275.3       168.2       2,400       275.3       275.3       168.2       2,400         12       71.5       62.7       415.0       415.0       253.8       2,400       415.0       415.0       253.8       2,400         13       74.3       64.6       414.3       414.3       257.6       2,400       414.3       414.3       257.6       2,400       414.3       414.3       257.6       2,400         14       76.6       66.0       456.6       456.6       290.1       2,400       456.6       456.6       290.1       2,400       456.6       290.1       2,400         15       78.0       67.1       465.5       337.2       2,400       456.6       456.6       299.				27.3 G A	0.0	0.0	2 400	8.4	0.0	0.0	2.400
9       62.4       58.6       79.2       79.2       80.4       2,400       79.2       79.2       80.4       2,400         10       65.2       59.6       142.9       142.9       105.4       2,400       142.9       142.9       105.4       2,400         11       68.3       61.1       275.3       275.3       168.2       2,400       275.3       275.3       168.2       2,400         12       71.5       62.7       415.0       415.0       253.8       2,400       415.0       415.0       253.8       2,400         13       74.3       64.6       414.3       414.3       257.6       2,400       414.3       414.3       257.6       2,400         14       76.6       66.0       456.6       290.1       2,400       456.6       456.6       290.1       2,400       456.6       290.1       2,400         15       78.0       67.1       465.5       465.5       299.4       2,400       456.6       456.6       299.1       2,400         16       78.5       67.5       514.5       514.5       337.2       2,400       456.5       465.5       299.4       2,400         18       77					97 A	93.5	2 400	87.6	87.6	83.5	2.400
10       65.2       59.6       142.9       142.9       105.4       2,400       142.9       142.9       105.4       2,400         11       68.3       61.1       275.3       275.3       168.2       2,400       275.3       275.3       168.2       2,400         12       71.5       62.7       415.0       415.0       253.8       2,400       415.0       415.0       253.8       2,400         13       74.3       64.6       414.3       414.3       257.6       2,400       415.0       415.0       253.8       2,400         14       76.6       66.0       456.6       456.6       290.1       2,400       456.6       456.6       290.1       2,400       456.6       290.1       2,400         15       78.0       67.1       465.5       465.5       299.4       2,400       465.5       465.5       299.4       2,400       465.5       299.4       2,400         16       78.5       67.5       514.5       537.2       2,400       514.5       514.5       337.2       2,400       514.5       514.5       337.2       2,400         17       78.2       67.9       550.9       550.9       367.1				70 2	79.2	90.4	2,400	79.2	79.2	80.4	2.400
11       68.3       61.1       275.3       275.3       168.2       2,400       275.3       275.3       168.2       2,400         12       71.5       62.7       415.0       415.0       253.8       2,400       415.0       415.0       253.8       2,400         13       74.3       64.6       414.3       414.3       257.6       2,400       414.3       414.3       257.6       2,400         14       76.6       66.0       456.6       456.6       290.1       2,400       456.6       456.6       290.1       2,400         15       78.0       67.1       465.5       465.5       299.4       2,400       465.5       465.5       299.4       2,400       465.5       299.4       2,400         16       78.5       67.5       514.5       514.5       337.2       2,400       514.5       514.5       337.2       2,400         17       78.2       67.9       550.9       550.9       367.1       2,400       550.9       550.9       367.1       2,400         18       77.5       68.0       499.0       326.7       2,400       499.0       379.7       379.7       245.9       2,400				147.9	142.9	105.4	2,400	142.9	142.9	105.4	2,400
12       71.5       62.7       415.0       415.0       253.8       2,400       415.0       415.0       253.8       2,400         13       74.3       64.6       414.3       414.3       257.6       2,400       414.3       414.3       257.6       2,400         14       76.6       66.0       456.6       456.6       290.1       2,400       456.6       456.6       290.1       2,400         15       78.0       67.1       465.5       465.5       299.4       2,400       465.5       465.5       299.4       2,400       465.5       299.4       2,400         16       78.5       67.5       514.5       514.5       337.2       2,400       514.5       514.5       337.2       2,400         17       78.2       67.9       550.9       550.9       367.1       2,400       550.9       550.9       367.1       2,400         18       77.5       68.0       499.0       499.0       326.7       2,400       499.0       499.0       326.7       2,400         19       76.3       69.3       379.7       379.7       245.9       2,400       379.7       379.7       245.9       2,400				275.3	275.3	168.2	2,400	275.3		110.0	2 800
13       74.3       64.6       414.3       414.3       257.6       2,400       414.3       414.3       257.6       2,400         14       76.6       66.0       456.6       456.6       290.1       2,400       456.6       456.6       290.1       2,400         15       78.0       67.1       465.5       465.5       299.4       2,400       465.5       465.5       299.4       2,400         16       78.5       67.5       514.5       514.5       337.2       2,400       514.5       514.5       337.2       2,400         17       78.2       67.9       550.9       550.9       367.1       2,400       550.9       550.9       367.1       2,400         18       77.5       68.0       499.0       499.0       326.7       2,400       499.0       499.0       326.7       2,400         19       76.3       69.3       379.7       379.7       245.9       2,400       379.7       379.7       245.9       2,400         20       74.7       70.0       348.0       348.0       228.0       2,400       348.0       348.0       228.0       2,400         21       72.7       69.0       <				415.0	415.0	253.8	2,400	415.0	415.0	253.8	2,400
14       76.6       66.0       456.6       456.6       290.1       2,400       456.6       290.1       2,400         15       78.0       67.1       465.5       465.5       299.4       2,400       465.5       465.5       299.4       2,400         16       78.5       67.5       514.5       514.5       337.2       2,400       514.5       514.5       337.2       2,400         17       78.2       67.9       550.9       550.9       367.1       2,400       550.9       550.9       367.1       2,400         18       77.5       68.0       499.0       499.0       326.7       2,400       499.0       499.0       326.7       2,400         19       76.3       69.3       379.7       379.7       245.9       2,400       379.7       379.7       245.9       2,400         20       74.7       70.0       348.0       348.0       228.0       2,400       348.0       328.0       228.0       2,400         21       72.7       69.0       290.0       290.0       192.0       2,400       290.0       290.0       192.0       2,400         22       70.6       67.3       190.0       <				414.3	414.3	257.6	2.400	414.3	414.3	257.6	2,400
16     78.5     67.5     514.5     514.5     337.2     2,400     514.5     514.5     337.2     2,400       17     78.2     67.9     550.9     550.9     367.1     2,400     550.9     550.9     367.1     2,400       18     77.5     68.0     499.0     499.0     326.7     2,400     499.0     499.0     326.7     2,400       19     76.3     69.3     379.7     379.7     245.9     2,400     379.7     379.7     245.9     2,400       20     74.7     70.0     348.0     348.0     228.0     2,400     348.0     348.0     228.0     2,400       21     72.7     69.0     290.0     290.0     192.0     2,400     290.0     290.0     192.0     2,400       22     70.6     67.3     190.0     190.0     136.9     2,400     190.0     190.0     136.9     2,400       23     68.3     65.4     121.4     121.4     121.4     121.4     121.4     121.4     121.4     121.4     121.4     121.4     121.4     121.4     121.4     121.4     121.4     121.4     121.4     121.4     121.4     103.2     2,400				456.6	456.6	290.1	2,400	456.6	456.6	290.1	2,400
16     78.5     67.5     514.5     514.5     337.2     2,400     514.5     514.5     337.2     2,400       17     78.2     67.9     550.9     550.9     367.1     2,400     550.9     550.9     367.1     2,400       18     77.5     68.0     499.0     499.0     326.7     2,400     499.0     499.0     326.7     2,400       19     76.3     69.3     379.7     379.7     245.9     2,400     379.7     379.7     245.9     2,400       20     74.7     70.0     348.0     348.0     228.0     2,400     348.0     348.0     228.0     2,400       21     72.7     69.0     290.0     290.0     192.0     2,400     290.0     290.0     192.0     2,400       22     70.6     67.3     190.0     190.0     136.9     2,400     190.0     190.0     136.9     2,400       23     68.3     65.4     121.4     121.4     121.4     121.4     121.4     121.4     121.4     121.4     121.4     121.4     121.4     121.4     121.4     121.4     121.4     121.4     121.4     121.4     121.4     103.2     2,400				465.5	465.5	299.4	2,400	465.5			
17       78.2       67.9       550.9       550.9       367.1       2,400       550.9       550.9       367.1       2,400         18       77.5       68.0       499.0       499.0       326.7       2,400       499.0       326.7       2,400         19       76.3       69.3       379.7       379.7       245.9       2,400       379.7       379.7       245.9       2,400         20       74.7       70.0       348.0       348.0       228.0       2,400       348.0       348.0       228.0       2,400         21       72.7       69.0       290.0       290.0       192.0       2,400       290.0       290.0       192.0       2,400         22       70.6       67.3       190.0       190.0       136.9       2,400       190.0       190.0       136.9       2,400         23       68.3       65.4       121.4       121.4       121.4       121.4       121.4       121.4       121.4       103.2       2,400						337.2	2.400	514 5	514 5	337.2	2,400
18     77.5     68.0     499.0     499.0     326.7     2,400     499.0     499.0     326.7     2,400       19     76.3     69.3     379.7     379.7     245.9     2,400     379.7     379.7     245.9     2,400       20     74.7     70.0     348.0     348.0     228.0     2,400     348.0     348.0     228.0     2,400       21     72.7     69.0     290.0     290.0     192.0     2,400     290.0     290.0     192.0     2,400       22     70.6     67.3     190.0     190.0     136.9     2,400     190.0     190.0     136.9     2,400       23     68.3     65.4     121.4 <th></th> <th></th> <th></th> <th></th> <th></th> <th>367.1</th> <th>2.400</th> <th>550.9</th> <th>550.9</th> <th>367.1</th> <th>2,400</th>						367.1	2.400	550.9	550.9	367.1	2,400
19     76.3     69.3     379.7     379.7     245.9     2,400     379.7     379.7     245.9     2,400       20     74.7     70.0     348.0     348.0     228.0     2,400     348.0     348.0     228.0     2,400       21     72.7     69.0     290.0     290.0     192.0     2,400     290.0     290.0     192.0     2,400       22     70.6     67.3     190.0     190.0     136.9     2,400     190.0     190.0     136.9     2,400       23     68.3     65.4     121.4     121.4     103.2     2,400     121.4     121.4     103.2     2,400							2,400	499.0	499.0	326.7	2,400
21     72.7     69.0     290.0     290.0     192.0     2,400     290.0     290.0     192.0     2,400       22     70.6     67.3     190.0     190.0     136.9     2,400     190.0     190.0     136.9     2,400       23     68.3     65.4     121.4     121.4     103.2     2,400     121.4     121.4     103.2     2,400					379.7	245.9	2.400	379.7	379.7	245.9	2,400
21     72.7     69.0     290.0     290.0     192.0     2,400     290.0     290.0     192.0     2,400       22     70.6     67.3     190.0     190.0     136.9     2,400     190.0     190.0     136.9     2,400       23     68.3     65.4     121.4     121.4     103.2     2,400     121.4     121.4     103.2     2,400					348.0	228.0	2,400	348.0		228.0	2,400
23 68.3 65.4 121.4 121.4 103.2 2,400 121.4 121.4 103.2 2,400						192.0	2,400	290.0	290.0	192.0	2,400
23 68.3 65.4 121.4 121.4 103.2 2,400 121.4 121.4 103.2 2,400				190.0	190.0	136.9	2,400	190.0	190.0	135.9	2,400
				121.4	121.4	103.2	2,400	121.4	121.4	103.2	2,400
		66.1								93.9	

# ECO IH-4

---- BUILDING COOLING DEMANDS AND THERMAL STORAGE----

June

			Design						
	Desi	gn	Cooling	Chiller	Chiller	Storage			
	DADB	DANB	Load	Load	Demand	Capacity			
Hour	(F)	(F)	(Ton)	(Ton)	(比量)	(Ton-Hr)			
1	68.7	65.1	0.0	0.0	9.0	5,000			
2	67.8	64.4	0.0	0.0	0.0	5,000			
3	67.0	63.5	0.0	0.0	0.0	5,000			
4	66.4	62.7	0.0	0.0	0.0	5,000			
5	66.3	62.7	0.0	0.0	0.0	5,000			
6	66.6	63.7	0.0	0.0	0.0	5,000			
7	67.6	64.5	0.0	0.0	0.0	5,000			
8	69.3	65.1	0.0	0.0	0.0	5,000			
9	71.8	66.0	65.3	65.3	84.3	5,000			
10	74.6	67.6	109.2	109.2	132.0	5,000			
11	77.8	69.8	241.8	241.8	193.4	5,000			
12	80.9	71.9	384.5	0.0	0.0	4,611			
13	83.2	73.5	353.7	0.0	0.0	4,254			
14	84.7	74.4	435.0	0.0	0.0	3,816			
15	85.3	74.6	542.1	0.0	0.0	3,271			
16	84.7	74.5	682.4	0.0	0.0	2,586			
17	83.4	73.5	8.608	0.0	0.0	1,777			
18	81.3	71.5	768.0	768.0	517.3	1,777			
19	78.8	70.1	652.3	652.3	426.8	1,777			
20	76.3	70.0	591.1	591.1	385.2	1,777			
21	74.2	69.5	546.4	750.0	727.5	1,979			
22	72.3	68.7	422.4	750.0	722.5	2,305			
23	70.8	67.1	246.2	750.0	712.7	2,807			
24	69.7	65.8	170.5	750.0	704.9	3,384			

				¥e	ekday		Saturday				
	Ty	pical	Cooling	Chiller	Chiller	Storage	Cooling	Chiller	Chiller	Storage	
	DADE	DANB	Load	Load	Desand	Capacity	Load	Load	Desand	Capacity	
Hour	<b>(F)</b>	(F)	(Ton)	(Ton)	(k#)	(Ton-Hr)	(Ton)	(Ten)	(kW)	(Ten-Hr)	
1	67.6	65.3	119.5	750.0	702.0	4,012	125.9	750.0	702.0	3,949	
2	65.0	63.9	103.2	750.0	693.9	4,655	102.7	750.0	693.9	4,593	
3	64.6	62.4	79.4	427.7	364.3	5,000	79.5	490.3	417.9	5,000	
4	63.7	61.3	65.3	65.3	. 79.6	5,000	65.3	65.3	79.6	5,000	
5	63.0	60.8	69.4	69.4	84.0	5,000	69.4	69.4	84.0	5,000	
6	62.8	61.2	153.4	153.4	138.8	5,000	153.5	153.5	138.8	5,000	
7	63.4	61.7	195.5	195.5	156.5	5,000	195.5	195.5	156.5	5,000	
8	65.1	62.3	185.3	185.3	153.5	5,000	185.6	185.6	153.6	5,000	
9	67.6	63.3	220.8	220.8	170.3	5,000	220.8	220.8	170.3	5,000	
10	70.7	65.2	286.9	286.9	204.0	5,000	288.9	285.9	204.0	5,000	
11	74.0	67.5	432.3	432.3	283.5	5,000	432.3	432.3	283.5	5,000	
12	77.1	69.8	557.5	0.0	0.0	4,438	557.6	0.0	0.0	4,438	
13	79.6	71.6	535.2	0.0	0.0	3,900	535.2	0.0	0.0	3,900	

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				We	ekday		Saturday			
	Ty	pical				Storage				
	DADB	DAWE	Load	Load	Demand	Capacity	Load	Load	Demand	Capacity
Hour	(F)	(F)	(Ton)	(Ten)	(kW)	Capacity (Ton-Hr)	(Ton)	(Ion)	(kW)	(Ton-Hr)
14	81.3	72.7	534.2	0.0	0.0	3,362	534.2	0.0	0.0	3,362
15	81.8	72.8	561.4	0.0	0.0	2,798	561.4	0.0	0.0	2,798
16	B1.6	73.1	609.6	0.0	0.0	2,186	609.6	0.0	0.0	2,186
17	81.0	72.7	678.8	0.0	0.0	1,506	609.6 678.8	0.0	0.0	1,506
18	80.0	71.6	665.1	665.1	441.7 360.2	1,506	665.1 542.0	665.1	441.7	1,506
19	78.7	71.3	542.0	542.0	360.2	1,506	542.0	542.0	360.2	1,506
20	77.1	72.0	496.4		335.3	1,506	496.4	496.4		
21	75.3	71.8	448.1	750.0	742.1	1,807 2,217	448.1	750.0	742.1	1,807
22	73.3	71.0	338.5		737.0	2,217	338.5	750.0	737.0	2,217
23	71.3	68.9	227.4	750.0	723.8	2,738	227.4	750.0	723.8	2,738
24	69.4	66.8	158.1	750.0	710.9	2,738 3,327	158.1	750.0	710.9	3,327
				,					<b>.</b>	
	Tu	niral				Storage				
	DADB	DAWB	load	) nad	Desand	Canadity	inad	i nad	Special	Canarity
Hour	(F)	(F)	(Ten)	(Inn)	(177)	Capacity (Ton-Hr)	(Ton)	(Top)	(FK)	(Ton-Hr)
11001	(1.7		(1011)	(1011)	(68)	(10:111)	(1011)		( ;	( i en in ;
1	67.6	65.3	125.9	750.0	702.0	3.949	125.9	750.0	702.0	3,949
2	66.0	63.9	102.7		693.9	3,949 4,593	102.7	750.0	702.0 693.9	4,593
3	64.6	62.4	79.5		417.9	5,000	79.5	490.3	417.9	
4	63.7	61.3	65.3	65.3	79.6	5.000	65.3	65.3	79.6	
5	65.0	60.8	69.4	69.4	84.0	5,000 5,000	69.4	69.4	79.6 84.0	5,000
6	62.8	61.2	153.5		138.8	5.000	153.5	153.5	138.8	5,000
7	63.4	61.7	195.5		156.5	5.000	153.5 195.5	195.5	156.5	5,000
8	65.1	52.3	185.6		153.6	5,000	185.6	185.6	153.6	5,000
9	67.6	63.3	220.8	220.8				220.8	170.3	5,000
10	70.7	65.2	286.9	286.9	170.3 204.0	5,000 5,000	286.9	286.9	170.3 204.0	5,000
11	74.0	67.5	432.3	432.3	283.5	5,000	432.3 557.6 535.2	432.3		5,000
12	77.1	69.8	557.6	0.0	0.0	4,438	557.6	0.0	0.0	4,438
13	79.5	71.6	535.2	0.0	0.0	3,900	535.2	0.0	0.0	3,900
14	81.3	72.7	534.2	0.0	0.0	3,362 2,798	534.2	0.0		
15	81.8	72.8	561.4	0.0	0.0	2,798	534.2 561.4	0.0	0.0	2,798
16	81.6	73.1	609.6	0.0	0.0	2,186	609.6	0.0	0.0	2,186
17	81.0	72.7	678.8	0.0	0.0	2,186 1,506	678.8	V. 0	V 3 V	
18	80.0	71.6	665.1		441.7	1,506	665.1	665.1	441.7	1,506
19	78.7	71.3	542.0		360.2	1,506 1,506	542.0	542.0	360.2	1,506
20	77.1	72.0	496.4		335.3	1,506	496.4	770.7	5,6,5,6,6,7	1,000
21	75.3	71.8	448.1		742.1	1,807	448.1	750.0	742.1	1,807
22	73.3	71.0	338.5		737.0	2,217	338.5	750.0	737.0	2.217
23	71.3	68.9	227.4		723.8	1,807 2,217 2,738	227.4			
24	69.4	66.8	158.1	750.0	710.9	3,327	158.1	750.0	710.9	3,327

---- BUILDING COOLING DEMANDS AND THERMAL STORAGE----

July

			Design						
	Desi	ign	Cooling	Chiller	Chiller	Storage			
	DADB	DAKE	Load	Load	Demand	Capacity			
Hour	(F)	(F)	(Ton)	(Ton)	(kW)	(Ton-Hr)			
1	73.4	68.8	258.3	750.0	723.1	3,816			
2	72.3	67.9	206.7	750.0	717.6	4,356			
3	71.4	67.2	185.6	750.0	713.3	4,917			
4	70.7	67.0	180.9	267.4	259.4	5,000			
5	70.5	66.9	252.9	252.9	192.2	5,000			
6	71.0	67.4	326.9	326.9	228.7	5,000			
7	72.1	68.4	380.7	380.7	258.8	5,000			
8	74.1	69.3	401.4	401.4	272.5	5,000			
9	77.0	70.1	420.5	420.6	285.5	5,000			
10	80.4	71.4	494.4	494.4	332.0	5,000			
11	84.2	73.3	672.3	672.3	453.8	5,000			
12	87.8	75.5	775.6	0.0	0.0	4,220			
13	90.5	76.5	733.0	0.0	0.0	3,484			
14	92.3	75.8	763.3	0.0	0.0	2,718			
15	93.0	77.0	805.4	0.0	0.0	1,910			
16	92.3	76.7	891.8	0.0	0.0	1,017			
17	90.8	75.3	889.6	0.0	0.0	127			
18	88.3	74.2	850.2	860.2	604.9	127			
19	85.4	72.9	714.1	714.1	482.7	127			
20	82.4	73.4	680.5	680.5	460.1	127			
21	80.0	73.0	641.2	750.0	749.9	235			
22	77.7	72.3	559.5	750.0	745.3	426			
23	75.9	70.6	426.3	750.0	734.4	749			
24	74.6	69.4	280.2	750.0	726.9	1,218			

		#eekday						Saturday				
	Ty	pical	Cooling	Chiller	Chiller	Storage	Cooling	Chiller	Chiller	Storage		
	DADE	DAMB	Load	Load	Demand	Dapacity	Load	Load	Demand	Capacity		
Hour	(F)	(F)	(Ton)	(Ton)	(kH)	(Ton-Hr)	(Ton)	(Ton)	(k₩)	(Ton-Hr)		
1	74.3	71.0	259.7	750.0	737.0	1,708	265.3	750.0	737.0	2,566		
2	71.9	68.8	219.9	750.0	723.1	2,236	214.6	750.0	723.1	3,099		
3	69.9	67.0	167.1	750.0	712.1	2,817	167.3	750.0	712.1	3,679		
4	48.3	65.9	152.3	750.0	705.5	3,413	152.7	750.0	705.5	4,274		
5	67.4	65.2	203.0	750.0	.701.4	3,957	203.1	750.0	701.4	4,817		
6	67.0	64.9	256.9	750.0	699.7	4,447	256.9	443.6	387.1	5,000		
7	67.5	65.3	274.1	750.0	702.0	4,919	274.2	274.2	198.4	5,000		
. 8	68.8	65.6	262.6	347.1	313.3	5,000	262.6	262.6	193.7	5,000		
9	70.9	65.7	248.7	248.7	187.6	5,000	248.7	248.7	187.₺	5,000		
10	73.6	66.5	305.3	305.3	215.9	5,000	305.3	305.3	215.9	5,000		
11	76.7	67.9	454.0	454.0	296.6	5,000	454.0	454.0	296.6	5,000		
12	79.9	69.9	581.5	0.0	0.0	4,414	581.5	0.0	0.0	4,414		
13	83.0	71.3	563.2	0.0	0.0	3,848	563.2	0.0	0.0	3,848		

Trane Air Conditioning Economics By: C.D.S. MARKETINS

		-			akday		Saturday				
	7	1	Fli	Ph: 11	Chiller	Storage	Conline				
		oical	C001146	Chiller	Danie,	Capacity	Cantina	inai	line and	Capacity	
13	DADB	DANE	Load	171	DEMESSO	(Ton-Hr)	/Incl				
Hour	(F)	(F)	(160)	(100)	{ x n /	(1087mr)	(100)	(1011)	(89)	(Tun-nr)	
14	85.7	72.5	597.7	0.0	0.0	3,247	597.7		0.0	3,247	
15	87.8	73.9	654.3	0.0	0.0	2,590	654.3	0.0	0.0	2,590	
16	89.1	75.3	737.3	0.0	0.0	1,851	737.3	0.0	0.0	1,851	
17	89.5	75.5	810.6	0.0	0.0	1,039	810.6	0.0	0.0	1,039	
18	89.2	76.2	803.8	803.8	568.1	1,039	803.8	803.8	568.1	1,039	
19	88.3	76.7	700.3	700.3	489.9	1,039	700.3		489.9	1,039	
20	86.7	78.6	684.0	684.0	487.6	1,039			487.6	1,039	
21	84.7	78.8	656.5	750.0	788.8	1,131	656.5		788.8	1,131	
22	82.3	78.0	549.7	750.0	783.3	1,331	549.7			1,331	
23	79.6	75.4	419.7	750.0	765.7	1,660	419.7	750.0		1,660	
24	76.9	73.0	325.9	750.0	749.9	2,083	325.9	750.0	749.9	2,083	
				S	inday			H	londay		
	Tv	pical	Cooling	Chiller	Chiller	Storage					
	DADB	DANE	Load			Capacity					
Hour		<b>(F)</b>				(Ton-Hr)			(k₩)	(Ton-Hr)	
	74.7	71.0	265.3	750.0	737.0	2,565	265.3	750.0	737.0	2,585	
1	74.3 71.9	71.0 68.8	214.6	750.0		3,099					
2		67.0		750.0		3,679					
4	69.9 68.3	65.9	167.3 152.7	750.0		4,274				4,274	
5	67.4	65.2	203.1	750.0		4,817	203.1	750.0			
		64.9	256.9	443.6		5,000	256.9			5,000	
6 7	67.0	65.3	274.2			5,000	274.2			5,000	
8	67.5 68.8	65.6	262.6			5,000	262.6			5,000	
9	70.9	65.7	248.7			5,000	248.7			5,000	
10	73.6	66.5	305.3			5,000	305.3				
11	76.7	67.9	454.0			5,000	454.0			5,000	
12	79.9	69.9	581.5			4,414					
13	83.0	71.3	563.2			3,848					
14	85.7	72.5	597.7			3,247				3,247	
15	87.8	73.9	654.3			2,590					
16	89.1	75.3	737.3			1,851				1,851	
17	89.5	75.5	810.6			1,039	810.6			1,039	
18					568.1						
19	88.3	76.7				1,039	700.3			1,039	
20	86.7	78.6	684.0			1,039				1,039	
21	84.7	78.8	656.5			1,131	656.5			1,131	
22	82.3	78.0				1,331	549.7			1,331	
23	79.6	75.4	419.7			1,660	419.7			1,560	
23 24	76.9	73.4				2,083	325.9			2,083	
47	10.7	10.0	32 d . 7	7 0V 1V	171.7	2,5000	QED17	7 6 7 7 0		-,	

---- BUILDING COOLING DEMANDS AND THERMAL STORAGE----

August

			Design						
	Des:	ign	Cooling	Chiller	Chiller	Storage			
	DADR	DANE	Load	Load	Demand	Capacity			
Hour	(F)	(F)	(Ton)	(Ton)	(kW)	(Ton-Hr)			
1	70.5	64.5	164.0	750.0	697.4	2,667			
2	69.5	63.5	133.5	750.0	691.6	3,281			
3	68.7	63.0	120.1	750.0	6.883	3,909			
4	68.1	62.4	107.0	750.0	685.5	4,549			
5	67.9	62.6	162.3	617.4	540.5	5,000			
Ь	68.3	63.2	240.7	240.7	178.7	5,000			
7	69.3	64.1	261.5	261.5	189.8	5,000			
8	71.1	64.9	292.4	292.4	205.9	5,000			
9	73.7	66.1	328.4	328.4	226.1	5,000			
10	76.8	67.2	406.9	406.9	269.0	5,000			
11	80.2	68.9	583.6	583.6	376.4	5,000			
12	83.4	70.6	695.3	0.0	0.0	4,301			
13	85.8	71.5	664.3	0.0	0.0	3,633			
14	87.5	72.5	698.6	0.0	0.0	2,931			
15	88.1	72.7	727.3	0.0	0.0	2,202			
16	87.5	71.7	794.2	0.0	0.0	1,406			
17	86.0	70.6	806.4	0.0	0.0	598			
18	83.8	69.7	758.7	758.7	502.2	598			
19	81.2	68.5	598.2	598.2	384.5	598			
20	78.6	68.7	545.2	545.2	351.9	598			
21	76.4	68.8	454.4	750.0	723.1	893			
22	74.3	67.6	321.1	750.0	715.8	1,322			
23	72.7	66.4	220.8	750.0	708.5	1,850			
24	71.5	65.3	194.9	750.0	702.0	2,403			

				NE	ekday		Saturday			
	Ty	pical	Cooling	Chiller	Chiller	Storage	Cooling	Chiller	Chiller	Storage
	DADB	DAWB	Load	Load	Demand	Capacity	Load	Load	Demand	Capacity
Hour	(F)	(F)	(Ton)	(Ton)	(kW)	(Ton-Hr)	(Ton)	(Ton)	(k₩)	(Ton-Hr)
1	70.1	65.3	145.1	750.0	702.0	3,006	150.5	750.0	702.0	3,997
2	68.2	63.5	116.3	750.0	691.6	3,638	115.6	750.0	691.6	4,629
3	66.6	62.2	88.4	750.0	684.4	4,296	88.6	463.6	393.7	5,000
4	65.4	61.1	72.4	750.0	678.5	4,970	72.3	72.3	87.9	5,000
5	64.6	60.7	101.2	134.7	159.8	5,000	101.5	101.5	118.8	5,000
6	64.4	60.7	175.5	175.6	446.6	5,000	175.5	175.5	146.6	5,000
7	64.9	61.2	173.0	173.0	146.5	5,000	173.0	173.0	146.5	5,000
3	66.3	61.5	179.8	179.8	149.9	5,000	180.0	190.0	150.0	5,000
9	68.5	62.5	178.1	178.1	150.9	5,000	178.0	178.0	150.9	5,000
10	71.4	63.6	250.5	250.5	183,9	5,000	250.6	250.6	183.9	5,000
11	74.5	65.1	396.0	396.0	256.9	5,000	396.0	396.0	256.9	5,000
12	77.6	8.66	504.8	0.0	0.0	4,491	504.8	0.0	0.0	4,491
13	80.5	68.2	495.1	0.0	0.0	3.993	495.1	0.0	0.0	3.993

						Saturday				
	1									
		pical	_	Chiller	Chiller	Storage	Cooling	Chiller	Chiller	Storage
	DADB	DANE	Load	Load	Demand	Capacity	LDSD	Load	Demand	Capacity
Hour	{F}	(F)	(Ton)	(Ton)	(kW)	(Ton-Hr)	(Ton)	(Ton)	(kW)	(Ton-Hr)
14	82.7	69.7	525.9	0.0	0.0	3,464	525.9	0.0	0.0	3,464
15	84.2	70.7	562.3	0.0	0.0	2,898	562.3	0.0	0.0	2,898
16	84.6	70.5	612.6	0.0	0.0	2,283	612.6	0.0	0.0	2,283
17	84.4	70.4	668.2	0.0	0.0	1,613	668.2	0.0	0.0	1,613
18	83.6	70.7	640.3	640.3	420.8	1,613	640.3	640.3	420.8	1,613
19	82.4	70.7	496.1	496.1	330.4	1,613	495.1	496.1	330.4	1,613
20	80.8	71.9	476.3	476.3	323.1	1,613	476.3	476.3	323.1	1,613
21	78.9	72.4	433.7	750.0	746.0	1,928	433.7	750.0	746.0	1,928
22	76.8	71.1	330.5	750.0	737.6	2,346	330.5	750.0	737.6	2,346
23	74.5	69.3	243.3	750.0	726.2	2,851	243.3	750.0	726.2	2,851
24	72.2	67.2	198.3	750.0	713.3	3,401	198.3	750.0	713.3	3,401
				S	unday			<del>)</del>	londay	
	Ţγ	pical	Cooling	Chiller	Chiller	Storage	Cooling	Chiller	Chiller	Storage
	DADB	DANE	Load	Load	Demand	Capacity	Load	Load	Demand	Capacity
Hour	{F}	(F)	(Ton)			(Ton-Hr)			(kK)	(Ton-Hr)
	30.4		180 8	350.0	705.0	7 007	+EA E	750.0	702.0	3,997
1	70.1	65.3	150.5			3,997				
2	68.2	63.5	115.6	750.0		4,629				4,629
3	66.6	62.2	88.6	463.6		5,000	88.6			5,000
4	65.4	61.1	72.3	72.3		5,000	72.3			5,000
5	64.6	60.7	101.5	101.5		5,000	101.5			5,000
6	64.4	60.7	175.5	175.5		5,000	175.5			5,000
7	64.9	61.2	173.0	173.0	146.5	5,000	173.0			5,000
8	66.3	61.6	180.0	180.0	150.0	5,000	180.0			5,000
9	68.5	62.5	178.0	178.0		5,000	178.0			5,000
10	71.4	63.6	250.6	250.6		5,000	250.6			
11	74.5	65.1	396.0			5,000	396.0			5,000
12	77.6	66.8	504.8	0.0	0.0	4,491	504.8			4,491
13	80.5	68.2	495.1	0.0	0.0	3,993	495.1			3,993
14	82.7	69.7	525.9		0.0	3,464				3,464
15	84.2	70.7	562.3			2,899				2,898
16	84.6	70.5	612.6			2,283				2,283
17	84.4	70.4	668.2		0.0	1,613	668.2			1,613
18	83.6	70.7	640.3		420.8	1,613		640.3		
19	82.4	70.7	496.1	496.1	330.4	1,613	496.1			1,613
20	80.8	71.9	476.3	476.3	323.1	1,613	476.3			1,613
21	78.9	72.4	433.7	750.0	746.0	1,928	433.7			1,928
22	76.8	71.1	330.5	750.0	737.6	2,346	330.5			2,346
23	74.5	69.3	243.3	750.0	726.2	2,851	243.3	750.0		2,851
24	72.2	67.2	198.3	750.0	.713.3	3,401	198.3	750.0	713.3	3,401

---- BUILDING COOLING DEMANDS AND THERMAL STORAGE----

September

			Design								
	Desi	ign	Cooling	Chiller	Chiller	Storage					
	DADR	DANE	Load	Load	Demand	Capacity					
Hour	(F)	(F)	(Ton)	(Ton)	(k¥)	(Ton-Hr)					
1	64.3	60.7	76.6	750.0	676.3	4,071					
2	63.3	59.8	60.2	750.0	671.7	4,758					
3	62.4	59.2	48.1	294.0	256.1	5,000					
4	61.8	58.5	35.4	35.4	42.0	5,000					
5	61.6	58.3	42.2	42.2	50.2	5,000					
ė	62.0	58.7	54.3	54.3	64.5	5,000					
7	63.1	59.8	142.1	142.1	132.4	5,000					
8	64.9	61.3	145.5	146.5	136.4	5,000					
9	67.5	62.3	207.6	207.6	162:7	5,000					
10	70.6	63.4	305.6	305.6	208.3	5,000					
11	74.0	65.1	491.7	491.7	308.0	5,000					
12	77.3	66.6	611.3	0.0	0.0	4,385					
13	79.7	68.1	579.7	0.0	0.0	3,801					
14	81.3	68.9	596.3	0.0	0.0	3,202					
15	81.9	69.3	523.8	0.0	0.0	2,576					
16	81.3	8.86	684.1	0.0	0.0	1,890					
17	79.9	68.2	694.6	0.0	0.0	1,194					
18	77.7	67.0	653.5	653.5	415.7	1,194					
19	75.0	66.9	506.2	506.2	322.3	1,194					
20	72.4	66.6	369.5	369.5	247.9	1,194					
21	70.2	65.3	283.2	750.0	702.0	1,659					
22	69.1	63.7	159.8	750.0	692.8	2,238					
23	66.5	62.5	112.6	750.0	686.1	2,874					
24	65.3	61.6	96.5	750.0	681.1	3,525					

				We	ekday	Saturday				
	Ty	pical	Cooling	Chiller	Chiller	Storage	Cooling	Chiller	Chiller	Storage
	DADE	DAME	Load	Load	Demand	Capacity	Load	Load	Demand	Capacity
Hour	{F}	(F)	(Ton)	(Ton)	(kW)	(Ton-Hr)	(Ton)	(Ton)	(kW)	(Ton-Hr)
1	63.9	61.5	68.5	750.0	680.6	4,204	74.8	628.5	546.7	5,000
2	62.0	59.7	47.6	750.0	671.1	4,903	48.1	48.1	57.6	5,000
3	60.4	58.4	26.6	127.8	154.4	5,000	26.6	26.6	31.6	5,000
4	59.2	57.1	15.4	0.0	0.0	5,000	15.4	0.0	0.0	5,000
5	58.4	56.3	19.2	0.0	0.0	5,000	19.2	0.0	0.0	5,000
6	58.2	56.1	24.3	24.3	28.9	5,000	24.3	24.3	28.9	5,000
7	58.7	56.7	8.4	0.0	0.0	5,000	8.4	0.0	0.0	5,000
8	60.1	57.9	87.6	87.6	104,0	5,000	87.6	87.6	104.0	5,000
9	62.4	58.6	79.2	79.2	94.1	5,000	79.2	79.2	94.1	5,000
10	65.2	59.6	142.2	142.2	132.4	5,000	142.9	142.9	132.7	5,000
11	68.3	61.1	275.3	275.3	189.1	5,000	275.3	275.3	189.1	5,000
12	71.5	62.7	415.0	0.0	0.0	4,581	415.0	0.0	0.0	4,581
13	74.3	64.6	413.9	0.0	0.0	4,163	414.3	0.0	0.0	4,163

Trane Air Conditioning Economics By: C.D.S. MARKETING

							Saturday			
	Tvi	niral				Storage				
	DADR	DANE				Capacity				Capacity
Hour		(F)				(Ton-Hr)				(Ton-Hr)
וטטוו	(, )	(1-)	(10:1)	(,011)	( *** )	(10h hi)	(10)()	(160)	( 6 10 )	(10) III )
14	75.5	65.0	456.6	0.0	0.0	3,703	456.6	0.0	0.0	3,703
15		67.1	465.5	0.0		3,235	465.5			3,235
16	78.5	67.5	514.5	0.0	0.0	2,718	514.5	0.0	0.0	2,718
17	78.2	67.9	550.9	0.0	0.0	2,165	550.9	0.0	0.0	2,165
18	77.5	68.0	499.0	499.0	322.2	2,165	499.0	499.0	322.2	2,165
19	76.3	69.3	379.7	379.7		2,165	379.7			2,165
20	74.7	70.0	348.0	348.0	246.4	2,165	348.0			2,165
21	72.7	69.0	290.0	750.0	724.4	2,623	290.0			2,623
	70.6	67.3	190.0	750.0		3,181	190.0			3,181
22							170.0	750.0		
23		65.4	121.4			3,807		750.0		3,807
24	66.1	63.6	104.2	750.0	692.2	4,450	104.2	750.0	692.2	4,450
				S	unday			H	londay	
	Tv	pical				Storage				
	BADB	DANB				Capacity		Load		Capacity
Hour	(F)					(Ton-Hr)				
1		61.5		628.8		5,000			547.1	
2	62.0	59.7	48.1	48.1	57.6	5,000	48.1	48.1	57.6	5,000
3	60.4	58.4	26.6	26.6	31.6	5,000	25.6	26.6	31.6	
4	59.2	57.1	15.4	0.0	0.0	5,000		0.0	0.0	5,000
5	58.4	56.3	19.2	0.0	0.0	5,000	19.2	0.0	0.0	5,000
6	58.2	56.1	24.3	24.3	28.9	5,000	24.3	24.3	28.9	5,000
7	58.7	56.7	8.4			5,000	8.4	0.0	0.0	5,000
8	60.1	57.9	87.6	87.6		5,000		87.6	104.0	5,000
9	62.4	58.5	79.2	79.2		5,000			94.1	5,000
10	65.2	59.6	142.9			5,000				
11	68.3	61.1	275.3	275.3		5,000			189.1	5,000
12	71.5	62.7	415.0	0.0	0.0	4,581				
13	74.3	64.6	414.3			4,163				
14	76.6	66.0	456.6			3,703				•
15	78.0	67.1	465.5			3,235				3,235
16		67.5	514.5			2,718				2,718
17	78.2	67.9	550.9			2,165				2,165
				499.0			499.0			
						2,165				2,165
19	76.3	69.3	379.7				379.7			
20	74.7	70.0	348.0			2,165				
21	72.7	69.0	290.0	750.0		2,623				
22	70.6	67.3	190.0		713.9	3,181	190.0			
23	68.3	65.4	121.4	750.0	702.6	3,807				3,807
24	65.1	63.6	104.2	750.0	692.2	4,450	104.2	750.0	692.2	4,450

## ECO IH-5

---- BUILDING COOLING DEMANDS AND THERMAL STORAGE----

June

			Design							
	Des:	ign	Coaling	Chiller	Chiller	Storage				
	DADE	DAME	Load	Load	Demand	Capacity				
Hour	(F)	<b>(F)</b>	(Ton)	(Ton)	(kW)	(Ton-Hr)				
1	68.7	65.1	0.0	0.0	0.0	2,600				
2	67.8	64.4	0.0	0.0	0.0	2,600				
3	67.0	63.5	0.0	0.0	0.0	2,600				
4	65.4	62.7	0.0	0.0	0.0	2,600				
5	66.3	62.7	0.0	0.0	0.0	2,600				
6	66.6	63.7	0.0	0.0	0.0	2,600				
7	67.6	64.5	0.0	0.0	0.0	2.600				
8	69.3	65.1	0.0	0.0	0.0	2,600				
9	71.8	66.0	65.3	65.3	84.1	2,600				
10	74.6	67.6	109.2	109.2	117.8	2,600				
11	77.8	69.8	241.8	241.8	181.1	2,600				
12	80.9	71.9	384.5	384.5	262.4	2,600				
13	83.2	73.5	353.7	0.0	0.0	2,244				
34	84.7	74.4	435.0	0.0	0.0	1,807				
15	85.3	74.6	542.1	0.0	0.0	1,264				
16	84.7	74.5	682.4	682.4	475.9	1,264				
17	83.4	73.5	806.8	806.8	577.8	1,264				
18	81.3	71.5	768.0	768.0	534.5	1,264				
19	78.8	70.1	652.3	652.3	434.7	1,264				
20	76.3	70.0	591.1	591.1	388.7	1,264				
21	74.2	69.5	546.4	546.4	355.5	1,264				
22	72.3	68.7	422.4	422.4	274.8	1,264				
23	70.8	67.1	246.2	246.2	177.8	1,264				
24	69.7	65.8	170.5	170.5	140.9	1,264				

				¥e	ekday		Saturday				
	Ty	pical	Cooling	Chiller	Chiller	Storage	Cooling	Chiller	Chiller	Storage	
	DADB	DAME	Load	Load	Demand	Capacity	Load	Load	Desand	Capacity	
Hour	<b>(</b> F)	(F)	(Ton)	(Ton)	(kW)	(Ton-Hr)	(Ton)	(Ton)	(k¥)	(Ton-Hr)	
1	67.6	65.3	119.5	630.0	589.6	1,773	125.9	630.0	589.6	1,469	
2	66.0	63.9	103.2	630.0	582.8	2,299	102.7	630.0	582.8	1,994	
3	64.6	62.4	79.4	382.5	325.4	2,600	79.5	630.0	575.8	2,543	
4	63.7	61.3	65.3	65.3	79.4	2,600	65.3	124.7	141.7	2,600	
5	63.0	60.8	69.4	69.4	-83.8	2,600	59.4	69.4	83.8	2,600	
ć	62.8	61.2	153.4	153.4	126.4	2,500	153.5	153.5	126.4	2,600	
7	63.4	61.7	195.5	195.5	144.6	2,600	195.5	195.5	144.6	2,600	
8	65.1	62.3	185.3	185.3	141.3	2,600	185.6	185.6	141.5	2,600	
9	67.6	63.3	220.8	220.8	158.6	2,600	220.8	220.8	158.6	2,600	
10	70.7	65.2	285.9	286.9	193.3	2,600	285.9	286.9	193.3	2,600	
11	74.0	67.5	432.3	432.3	276.7	2,600	432.3	432.3	276.7	2,600	
12	77.1	69.8	557.6	557.6	364.2	2,600	557.6	557.6	364.2	2,600	
13	79.6	71.6	535.2	0.0	0.0	2,063	535.2	0.0	0.0	2,063	

				No.	udau		Saturday			
	Tur	vien!	Conline	Chiller	Chiller	Storage	Conline	Chiller	Chiller	Storage
	DADE	DAME	Load	inad	Dosand	Capacity	Inad	Load	Demand	Capacity
Hour		(F)	(Inn)	(Ton)	(141)	(Ton-Hr)	(Ton)	(Ten)	(大統)	(Ipn-Hr)
กบบ:	(F)	(1)	(1011)	(1011)	(hm)	time in i	(1011)	(12)	()	( , , , , , , , , , , , , , , , , ,
14	81.3	72.7	534.2	0.0	0.0	1,527	534.2	0.0	0.0	1,527
15	81.8	72.8	561.4	0.0	0.0	964	561.4	0.0	0.0	964
16	81.6	73.1	609.6	609.6		964	609.6	609.6	413.5	964
17		72.7	678.8	678.8	465.6	964	679.8	678.8	465.6	964
18		71.6	655.1	665.1	450.4	964	665.1	665.1	450.4	964
19		71.3	542.0	542.0	358.3	954	542.0	542.0	358.3	954
20	77.1	72.0	496.4	496.4	330.7	964	496.4	496.4	330.7	964
21	75.3	71.8	448.1	448.1	299.8	954	448.1	448.1	299.8	964
22	73.3	71.0	338.5		234.0	964	338.5	338.5	234.0	964
23	71.3	68.9	227.4			964	227.4	227.4	172.4	964
24	69.4	66.8	158,1	158.1	137.1	964	158.1	158.1	137.1	964
				S	unday			<del>}</del>	londay	
	Ty	pical	Cooling	Chiller	Chiller	Storage Capacity	Copling	Chiller	Chiller	Storage
	DADB	DAMB	Load	Load	Demand	Capacity	Load	Load	Demand	Capacity
Hour	(F)	{F}	(Ton)	(Ton)	(kW)	(Ton-Hr)	(Ton)	(Ton)	(k₩)	(Ton-Hr)
								1 700 6	FOD :	
1		<b>55.</b> 3	125.9		589.6	1,468	125.9			
2	66.0	63.9	102.7		582.8	1,994	102.7	530.0		
2	64.6	62.4	79.5			2,543	79.5	630.0		
4	63.7	61.3	65.3		141.7	2,600	65.3	124.7	141.7	
5	63.0	60.8	69.4		83.8	2,600	69.4	69.4	83.8	2,600
6	62.8	61.2	153.5			2,600			126.4	2,600
7	63.4	61.7	195.5			2,600	195.5		144.6	2,600
8	65.1	62.3	185.6	185.6		2,600	185.6			2,600
9	67.6	63.3	220.8			2,600	220.8			2,600
10	70.7	65.2	286.9			2,600				2,600
11	74.0	67.5	432.3			2,600		432.3	276.7	
12	77.1	69.8	557.6	557.6		2,600	557.6	557.6	364.2	2,600
13	79.6	71.6	535.2	0.0	0.0	2,063	535.2	0.0	0.0	2,063
14	81.3	72.7	534.2	0.0	0.0	1,527	534.2		0.0	1,527
15	81.8	72.8	561.4		0.0				0.0	
16	81.6	73.1				964			413.5	964
17	81.0	72.7	678.8	678.8	465.6	964				964
18	80.0	71.6	665.1	665.1	450.4				450.4	
19	78.7	71.3	542.0			964	542.0			964
20	77.1	72.0	496.4	495.4		964	496.4			964
21	75.3	71.8	448.1	448.1	299.8	964	448.1			964
22	73.3	71.0	338.5			964	338.5			964
23	71.3	68.9	227.4			964	227.4			964
24	69.4	66.8	158.1	158.1	437.1	964	158.1	158.1	137.1	764

---- BUILDING COOLING DEMANDS AND THERMAL STORAGE----

July

			Design						
	Desi	gn	Cooling	Chiller	Chiller	Storage			
	DADE	DAME	Load	Load	Demand	Capacity			
Hour	(F)	(F)	(Ton)	(Ton)	{k#}	(Ton-Hr)			
1	73.4	8.83	258.3	630.0	607.4	1,335			
2	72.3	67.9	206.7	630.0	602.7	1,757			
3	71.4	67.2	185.6	630.0	599.1	2,200			
4	70.7	67.0	180.9	582.3	542.2	2,600			
5	70.5	66.9	252.9	252.9	180.5	2,600			
6	71.0	67.4	326.9	326.9	218.7	2,600			
7	72.1	68.4	380.7	380.7	250.3	2,600			
8	74.1	69.3	401.4	401.4	264.5	2,600			
9	77.0	70.1	420.6	420.6	278.0	2,600			
10	80.4	71.4	494.4	494.4	327.3	2,600			
11	84.2	73.3	672.3	672.3	462.9	2,600			
12	87.8	75.5	775.6	775.6	559.6	2,600			
13	90.5	76.5	733.0	0.0	0.0	1,865			
14	92.3	76.8	763.3	0.0	0.0	1,100			
15	93.0	77.0	805.4	0.0	0.0	294			
16	92.3	76.7	891.8	820.0	605.7	222			
17	90.8	75.3	889.6	820.0	598.6	153			
18	88.3	74.2	860.2	820.0	593.1	112			
19	85.4	72.9	714.1	714.1	495.2	112			
20	82.4	73.4	680.5	680.5	469.9	112			
21	80.0	73.0	641.2	641.2	437.2	112			
22	77.7	72.3	559.5	559.5	374.0	112			
23	75.9	70.6	426.3	426.3	282.9	112			
24	74.6	69.4	280.2	280.2	199.4	112			

		Weekday					Saturday			
	Ty	pical	Cooling	Chiller	Chiller	Storage	Cooling	Chiller	Chiller	Storage
	DADB	DAMB	Load	Load	Demand	Capacity	Load	Load	Demand	Capacity
Hour	(F)	{F}	(Ton)	(Ton)	(k₩)	(Ton-Hr)	(Ton)	(Ton)	(EW)	(Ton-Hr)
1	74.3	71.0	259.7	630.0	619.0	482	265.3	630.0	619.0	1,144
2	71.9	68.8	219.9	630.0	607.4	892	214.6	630.0	607.4	1,558
3	69.9	67.0	167.1	630.0	598.1	1,354	167.3	630.0	598.1	2,020
4	68.3	65.9	152.3	630.0	592.6	1,831	152.7	630.0	592.6	2,496
5	67.4	65.2	203.0	630.0	589.1	2,256	203.1	309.5	275.6	2,600
6	67.0	64.9	256.9	602.2	555.1	2,600	256.9	256.9	178.3	2,600
7	67.5	65.3	274.1	274.1	187.3	2,600	274.2	274.2	187.4	2,600
8	68.8	65.6	262.6	262.6	182.5	2,500	262.6	262.6	182.5	2,600
9	70.9	65.7	248.7	248.7	176.1	2,600	248.7	248.7	176.1	2,600
10	73.6	66.5	305.3	305.3	205.5	2,600	305.3	305.3	205.5	2,500
11	76.7	67.9	454.0	454.0	290.6	2,600	454.0	454.0	290.6	2,600
12	79.9	69.9	581.5	581.5	381.5	2,600	581.5	581.5	381.5	2,600
13	83.0	71.3	563.2	0.0	0.0	2,035	563.2	0.0	0.0	2,035

	Hookday						Saturday				
	7	1									
		pical	-	Chiller	Description	Storage Capacity	Cooling	Look	Parang	Capacity	
	DADE	BANE	Load	1080	vewans	Lapacity	1080	171	Pesano		
Hour	(F)	<b>(F)</b>	(100)	(len)	(X#)	(Ton-Hr)	(101)	(100)	(KM)	(Ton-Hr)	
14	85.7	72.5	597.7	0.0	0.0	1,435		0.0		1,435	
15	87.8	73.9	654.3	0.0	0.0	780	654.3	0.0	0.0	780	
16	89.1	75.3	737.3	737.3	525.3	780	737.3	737.3	525.3	780	
17	89.5	75.5	810.6	810.6	591.1	780	810.6	810.6	591.1	780	
18	89.2	75.2	803.8	803.8	588.3	780	803.8	803.8	588.3	780	
19	88.3	76.7	700.3	700.3	500.1	780	700.3	700.3	500.1	780	
20	8Ł.7	78.6	684.0	684.0	494.6	780	684.0	684.0	494.6	780	
21	84.7	78.8	656.5	656.5	472.6	780	656.5	656.5	472.6	780	
22	82.3	78.0	549.7	549.7	389.2	780	549.7	549.7	389.2	780	
23	79.6	75.4	419.7	419.7	293.8	780	419.7	419.7	293.8	780	
24	76.9	73.0	325.9	325.9	232.2	780	325.9	325.9	232.2	780	
				9	iunday				londay		
	Ţγ	pical	Copline	Chiller	Chiller	Storage	Cooling	Chiller	Chiller	Storage	
	BADR	DAMB	Load	Load	Demand	Capacity	Load	Load	Demand	Capacity	
Hour	(F)	(F)	(Ton)	(Ton)	(k#)	(Ten-Hr)	(Ton)	(Ton)	(謝)	(Ton-Hr)	
	7, 7	74.0	265.3	170.0	***		265.3	630.0	619.0	1,144	
1	74.3	71.0				1,144				1,558	
2	71.9	68.8	214.6	630.0		1,558					
3	69.9	67.0	167.3	630.0	598.1	2,020	167.3	630.0		2,020	
4	68.3	65.9	152.7	630.0		2,496	152.7			2,496	
5	67.4	65.2	203.1	309.5		2,600	203.1				
6	67.0	64.9	256.9	256.9		2,600	256.9			2,600	
7	67.5	65.3	274.2	274.2	187.4	2,600	274.2		187.4	2,600	
8	69.9	65.6	262.6	262.6	182.5	2,600		262.6	182.5	2,600	
9	70.9	65.7	248.7	248.7		2,600	248.7			2,600	
10	73.6	66.5	305.3	305.3	205.5	2,600	305.3	305.3		2,600	
11	76.7	67.9	454.0	454.0		2,600	454.0				
12	79.9	69.9	581.5	581.5		2,600	581.5				
13	83.0	71.3	563.2	0.0		2,035				•	
14	85.7	72.5	597.7	0.0		1,435				1,435	
15	87.8	73.9	654.3			780					
16	89.1	75.3	737.3		525.3	780	737.3			780 780	
17	89.5	75.5	810.6	810.6		780	810.6			780	
18		76.2	803.8		588.3				588.3		
19	88.3	76.7	700.3	700.3	500.1	780	700.3	700.3	500.1	780	
20	86.7	78.6	684.0	684.0	494.6	780	684.0	684.0	494.6	780	
21	84.7	78.8	656.5	656.5	472.6	780	656.5	656.5	472.6	780	
22	82.3	78.0	549.7	549.7	389.2	780	549.7	549.7	389.2	780	
23	79.6	75.4	419.7	419.7	-293.8	780	419.7	419.7	293.8	780	
24	76.9	73.0	325.9	325.9	232.2	780	325.9	325.9	232.2	780	

---- BUILDING COOLING DEMANDS AND THERMAL STORAGE----

August

	Desi	ign	Cooling	Chiller	Chiller	Storage
	DADB	DANE	Load	Load	Demand	Capacity
Hour	(F)	{F}	(Ton)	(Ton)	(kW)	(Ton-Hr)
1	70.5	64.5	164.0	630.0	585.7	1,245
2	69.5	63.5	133.5	630.0	580.9	1,741
3	68.7	63.0	120.1	\$30.0	578.6	2,249
4	68.1	62.4	107.0	459.4	394.7	2,600
5	67.9	62.6	162.3	162.3	132.2	2,600
ć	68.3	63.2	240.7	240.7	167.3	2,600
7	69.3	64.1	261.5	261.5	178.7	2,600
8	71.1	64.9	292.4	292.4	195.3	2,600
9	73.7	66.1	328.4	328.4	216.3	2,600
10	75.8	67.2	406.9	406.9	261.4	2,600
11	80.2	68.9	583.6	583.6	379.5	2,600
12	83.4	70.6	695.3	695.3	470.4	2,600
13	85.8	71.5	664.3	0.0	0.0	1,934
14	87.5	72.5	698.6	0.0	0.0	1,233
15	88.1	72.7	727.3	0.0	0.0	505
15	87.5	71.7	794.2	794.2	558.1	505
17	86.0	70.6	806.4	806.4	563.7	505
18	83.8	69.7	758.7	758.7	518.7	505
19	81.2	68.5	598.2	598.2	388.6	505
20	78.6	68.7	545.2	545.2	352.1	505
21	76.4	68.8	454.4	454.4	293.8	505
22	74.3	67.6	321.1	321.1	216.2	505
23	72.7	66.4	220.8	220.8	164.5	505
24	71.5	65.3	194.9	194.9	150.7	505

				#e		Saturday				
	Ty	pical	Cooling	Chiller	Chiller	Storage	Cooling	Chiller	Chiller	Storage
	DADE	DAWE	Load	Load	Demand	Capacity	Load	Load	Demand	Capacity
Hour	(F)	(F)	(Ton)	(Ton)	(kW)	(Ton-Hr)	(Ton)	(Ton)	(kW)	(Ton-Hr)
1	70.1	65.3	145.1	630.0	589.6	990	150.5	630.0	589.6	1,490
2	68.2	63.5	116.3	630.0	580.9	1,503	115.6	630.0	580.9	2,004
3	66.6	62.2	88.4	630.0	574.8	2,043	88.6	630.0	574.8	2,543
4	65.4	61.1	72.4	630.0	569.8	2,599	72.3	130.9	144.9	2,600
5	64.6	60.7	101.2	104.4	,129.4	2,600	101.5	101.5	105.8	2,600
6	64.4	60.7	175.6	175.6	134.6	2,600	175.5	175.5	134.6	2,600
7	64.9	61.2	173.0	173.0	134.3	2,600	173.0	173.0	134.4	2,600
8	66.3	61.6	179.8	179.8	137.8	2,600	180.0	180.0	137.9	2,600
9	68.5	62.5	178.1	178.1	138.6	2,600	178.0	178.0	138.6	2,500
10	71.4	63.6	250.5	250.5	172.6	2,600	250.6	250.6	172.6	2,600
11	74.5	65.1	396.0	396.0	249.1	2,600	396.0	396.0	249.1	2,600
12	77.6	66.8	504.8	504.8	319.3	2,600	504.8	504.8	319.3	2,600
13	80.5	68.2	495.1	0.0	0.0	2,103	495.1	0.0	0.0	2,103

	Weekday						Saturday			
	Tyr	nical	Conling	Chiller	Chiller	Storage				
	DADE	DAWR				Capacity		Load		Capacity
Hour		(F)				(Ton-Hr)				(Ton-Hr)
,,,,,,	() ;	(11	(7077	(12)	(4;	(12	(	,		
14	82.7	69.7	525.9	0.0	0.0	1,575	525.9	0.0	0.0	1,575
15	84.2	70.7	562.3	0.0	0.0	1,012	562.3	0.0	0.0	1,012
16	84.6	70.5	612.6	617.6	406.2	1,012			406.2	1,012
17	84.4	70.4	668.2	668.2	448.1	1,012	668.2	668.2	448.1	1,012
18	83.6	70.7	640.3	640.3	427.8	1,012	640.3		427.8	1,012
19	82.4	70.7	496.1	496.1	325.8	1,012				1,012
20	80.8	71.9	476.3	476.3	317.6	1,012		476.3	317.6	1,012
21	78.9	72.4	433.7	433.7		1,012				1,012
22	76.8	71.1	330.5	330.5		1,012				
23	74.5	69.3	243.3		180.8	1,012			180.8	1,012
24	72.2	67.2	198.3	198.3	155.6	1,012	198.3			1,012
24	12.2	0/.2	176,5	110:0	100.0	1,011	17010	17010	20010	-,
				9	unday			H	onday	
	Tu	pical	Conline	Chiller	Chiller	Storage				
	DADB	BANE	Load	hani	Demand	Capacity	load	Load	Demand	Capacity
Hour		(F)		(Ton)	(FM)	(Ton-Hr)	(Ton)			
nour	() }	O i	(1011)	(1011)	1807	(Ten in )	(1011)	(	V 1	(
1	70.1	65.3	150.5	630.0	589.6	1,490	150.5	630.0	589.6	1,490
2	68.2	63.5	115.6	630.0		2,004		630.0	580.9	2,004
3	66.6	62.2	88.6	630.0		2,543	89.6		574.8	2,543
4	65.4	61.1	72.3	130.9		2,600	72.3	130.9	144.9	2,600
5	64.6	60.7	101.5	101.5		2,600	101.5			2,600
b	64.4	60.7	175.5	175.5		2,600	175.5			2,600
7	64.9	61.2	173.0	173.0		2,600				
8	66.3	61.6	180.0	180.0		2,600	180.0			
ģ	68.5	62.5	178.0	178.0		2,600				2,600
10	71.4	63.6	250.6	250.6		2,600		250.6		
11	74.5	65.1	396.0	396.0		2,500				
12	77.6	66.8	504.8	504.8		2,600				
13	80.5	68.2	495.1	0.0	0.0	2,103				
14	82.7	69.7	525.9			1,575				•
15	84.2	70.7	562.3		0.0	1,012				1,012
	84.6	70.5	612.6			1,012		612.6		1,012
16	84.4		668.2		448.1	1,012	668.2			1,012
17		70.4			427.8				427.8	•
18		70.7								1,012
19	82.4	70.7	496.1	496.1		1,012	496.1	496.1		1,012
20	80.8	71.9	476.3			1,012	476.3			
21	78.9	72.4	433.7			1,012	433.7			1,012
22	76.8	71.1	330.5			1,012	330.5			1,012
23	74.5	69.3	243.3			1,012	243.3			1,012
24	72.2	67.2	198.3	198.3	155.6	1,012	198.3	198.3	155.6	1,012

#### ---- BUILDING COOLING DEMANDS AND THERMAL STORAGE----

#### September

				D	esign	
	Desi	ign	Cooling	Chiller	Chiller	Storage
	DADB	BAHB	Load	Load	Demand	Capacity
Hour	(F)	{F}	(Ton)	(Ton)	(k#)	(Ton-Hr)
i	64.3	60.7	76.6	630.0	568.1	1,564
2	63.3	59.8	60.2	630.0	564.1	2,133
3	62.4	59.2	48.1	517.0	439.2	2,600
4	61.8	58.5	35.4	35.4	42.0	2,600
5	61.6	58.3	42.2	42.2	50.2	2,600
6	62.0	58.7	54.3	54.3	64.5	2,600
7	63.1	59.8	142.1	142.1	120.1	2,600
8	64.9	61.3	146.5	146.5	123.8	2,500
9	67.5	62.3	207.6	207.6	150.9	2,600
10	70.6	63.4	305.6	305.6	198.3	2,600
11	74.0	65.1	491.7	491.7	305.0	2,600
12	77.3	66.6	611.3	611.3	391.5	2,600
13	79.7	68.1	579.7	0.0	0.0	2,018
14	81.3	69.9	596.3	0.0	0.0	1,420
15	81.9	69.3	623.8	0.0	0.0	795
15	81.3	48.8	684.1	684.1	454.4	795
17	79.9	68.2	694.6	694.6	460.3	795
18	77.7	67.0	653.5	653.5	424.1	795
19	75.0	66.9	506.2	506.2	320.5	795
20	72.4	66.6	369.5	369.5	239.2	795
21	70.2	65.3	283.2	283.2	191.8	795
22	68.1	63.7	169.8	159.8	137.1	795
23	66.5	62.5	112.6	112.6	112.3	795
24	65.3	61.6	96.5	96.5	105.1	795

				#e	ekday		Saturday			
	Туг	pical	Cooling	Chiller	Chiller	Storage	Cooling	Chiller	Chiller	Storage
	DADB	DAMB	Load	Load	De≞and	Capacity	Load	Load	Demand	Capacity
Hour	(F)	(F)	(Ton)	(Ton)	(k₩)	(Ton-Hr)	(Ton)	(Ten)	(k₩)	(Ton-Hr)
1	63.9	61.5	68.5	630.0	571.6	1,356	74.8	630.0	571.6	1,813
2	62.0	59.7	47.6	630.0	563.7	1,938	48.1	630.0	563.7	2,393
3	60.4	58.4	26.6	630.0	558.2	2,539	25.6	235.1	207.3	2,600
4	59.2	57.1	15.4	78.0	113.8	2,600	15.4	0.0	0.0	2,600
5	58.4	56.3	19.2	19.2	- 22.8	2,600	19.2	19.2	22.8	2,600
6	58.2	56.1	24.3	24.3	28.9	2,600	24.3	24.3	28.9	2,600
7	58.7	56.7	8.4	0.0	0.0	2,600	8.4	0.0	0.0	2,600
8	60.1	57.9	87.6	87.5	99.4	2,600	87.6	87.6	99.4	2,600
9	62.4	58.6	79.2	79.2	94.1	2,600	79.2	79.2	94.1	2,600
10	65.2	59.6	142.2	142.2	120.1	2,600	142.9	142.9	120.4	2,600
11	68.3	61.1	275.3	275.3	178.7	2,600	275.3	275.3	178.7	2,600
12	71.5	62.7	415.0	415.0	253.8	2,600	415.0	415.0	253.8	2,600
13	74.3	64.6	413.9	0.0	0.0	2,184	414.3	0.0	0.0	2,184

							Saturday				
		pical				Storage					
	DADE		Load	Load	Demand	Capacity	Load	Load	Pemand	Capacity	
Hour	(F)	(F)	(Ton)	(Ton)	(k計)	(Ton-Hr)	(Ten)	(Ton)	(kW)	(Ton-Hr)	
14	76.6	66.0	456.6	0.0	0.0	1,726	455.6	0.0		1,725	
15	78.0	67.1	455.5	0.0	0.0	1,259		0.0	0.0	1,258	
16	78.5	67.5	514.5	514.5	327.8	1,259	514.5	514.5	327.8	1,258	
17	78.2	67.9	550.9	550.9	353.4	1,259	550.9	550.9	353.4	1,258	
18	77.5	68.0	499.0		319.2	1,259	499.0	499.0	319.2	1,258	
19	76.3	69.3	379.7	379.7	252.3	1,259	379.7	379.7	252.3	1,258	
20	74.7	70.0	348.0	348.0		1,259		348.0	236.7	1,258	
21	72.7	69.0	290.0	290.0	203.5	1,259		290.0	203.5	1,258	
22	70.6	67.3	190.0			1.259	190.0	190.0			
23	68.3	65.4	121.4		119.6	1,259	121.4	121.4	119.6	1,258	
24	66.1		104.2		110.6	1,259	104.2		110.6	1,258	
				9	unday				londav		
	Ty	pical	Cooling	Chiller	Chiller	Storage	Cooling	Chiller	Chiller	Storage	
	DADR	DAME	Load	Load	Demand	Capacity	Load	Load	Demand	Capacity	
Hour	<b>(F)</b>	(F)	(Ton)	(Ton)	{k₩}	(Ton-Hr)	(Ton)	(Ton)	(k量)	(Ton-Hr)	
1	63.9	61.5	74.8	630.0	571.6	1,813	74.8	630.0	571.6	1,813	
2	62.0	59.7	48.1		563.7	2,393	48.1	630.0	553.7	2,393	
3	60.4	58.4	26.6			2,600	26.6	235.4	207.5	2,600	
4	59.2	57.1	15.4	0.0	0.0			0.0	0.0	2,600	
5	58.4	56.3	19.2		22.8	2,600	19.2	19.2	22.8		
ė	58.2	56.1	24.3		28.9	2,600		24.3		2,600	
7	58.7	56.7	8.4			2,600				2,600	
8	60.1	57.9	87.6	87.6		2,600	87.6	87.6	99.4	2,600	
9	62.4	58.6	79.2		94.1	2,600	79.2	79.2	94.1	2,600	
10	65.2	59.6	142.9	142.9	120.4	2,600	142.9		120.4		
11	68.3	61.1	275.3		178.7	2,600		275.3			
12	71.5	62.7	415.0	415.0	253.8	2,600		415.0	253.8	2,600	
13	74.3	64.6	414.3	0.0	0.0	2,184	414.3		0.0	2,184	
14	76.6	66.0	456.6	0.0	0.0	1,725	456.6	0.0	0.0	1,725	
15	78.0	67.1	465.5		0.0	1.258	465.5	0.0	0.0	1,258	
16	78.5	67.5	514.5	514.5	327.8	1,258	514.5	514.5			
17	78.2	67.9	550.9	550.9	353.4	1,258	550.9	550.9		1,258	
18	77.5	58.0	499.0	499.0	319.2	1,258	499.0	499.0	319.2	1,258	
19	76.3	69.3				1,258	379.7	379.7		1,258	
20	74.7	70.0						348.0			
21	72.7	69.0			203.5	1,258	290.0	290.0			
22	70.5	67.3				1,258	190.0				
23	68.3	65.4				1,258	121.4	121.4	119.6		
24	66.1	63.6				1,258	104.2	104.2	110.6	1,258	

## ECO IT-1

---- BUILDING COOLING DEMANDS AND THERMAL STORAGE----

งินกร

			Design						
	Desi	Qn	Copling	Chiller	Chiller	Storage			
	DADE	DAMB	Load	Load	Demand	Capacity			
Hour	(F)	(F)	(Ton)	(Ton)	(k¥)	(Ton-Hr)			
1	68.7	65.1	0.0	0.0	0.0	3,300			
2	67.8	64.4	0.0	0.0	0.0	3,300			
3	67.0	63.5	0.0	0.0	0.0	3,300			
4	66.4	62.7	0.0	0.0	0.0	3,300			
5	66.3	62.7	0.0	0.0	0.0	3,300			
ò	66.6	63.7	0.0	0.0	0.0	3,300			
7	67.6	64.5	0.0	0.0	0.0	3,300			
8	69.3	65.1	0.0	0.0	0.0	3,300			
9	71.8	66.0	65.3	65.3	74.9	3,300			
10	74.6	67.6	109.2	109.2	96.3	3,300			
11	77.8	69.8	241.8	241.8	171.7	3,300			
12	80.9	71.9	384.5	384.5	277.1	3,300			
13	83.2	73.5	353.7	353.7	256.3	3.300			
14	84.7	74.4	435.0	435.0	326.8	3,300			
15	85.3	74.6	542.1	500.0	388.1	3,258			
16	84.7	74.5	682.4	500.0	387.8	3,076			
17	83.4	73.5	805.8	500.0	384.5	2,769			
18	81.3	71.5	768.0	500.0	378.2	2,501			
19	78.8	70.1	652.3	500.0	373.9	2,348			
20	76.3	70.0	591.1	500.0	373.6	2,257			
21	74.2	69.5	546.4	500.0	372.1	2,211			
22	72.3	68.7	422.4	422.4	300.5	2,211			
23	70.8	67.1	246.2	246.2	169.1	2,211			
24	69.7	65.8	170.5	170.5	124.6	2,211			

er Storage
nd Capacity
₩) (Ton-Hr)
.8 2,989
.5 3,300
.0 3,300
.0 3,300
.0 3,300
.0 3,300
.0 3,300
.0 3,300
.6 3,300
.2 3,300
.8 3,300
3,242
.5 3,207
0007153

	Weekday						Saturday			
	Tve	nical	Conline	Chiller	Chiller	Storage	Conline	Chiller	Chiller	Storage
	DADE	DANE	Load	Load	Demand	Capacity	Load	Load	Demand	Capacity
Hour	(F)	(F)	(Ton)	(Ton)	(k₩)	Capacity (Ton-Hr)	(Ton)	(Ton)	(kW)	(Ton-Hr)
			,	• • • • • • • • • • • • • • • • • • • •						
14	81.3	72.7	534.2	500.0	382.0	3,173	534.2	500.0	382.0	3,173
15	81.8	72.8	561.4	500.0	382.3	3,112	361.4	200.0	382.3	3,112
16	81.6	73.1	609.6		383.3	3,002	609.6	500.0	383.3	3,002
17	81.0	72.7			382.0			500.0	382.0	2,823
18	80.0	71.6	665.1	500.0	378.5	2,658	678.8 665.1	500.0	378.5	
19	78.7	71.3			377.6	2,616	542.0	500.0	377.6	7,616
20	77.1	72.0	496.4			2,616 2,616 2,616	495.4	456.4	377.6 376.3	2,616
21		71.8	448.1	448.1	376.3 331.1	2,616	448.1	448.1	331.1	2,616
22	73.3	71.0	338.5	338.5	239.0	2,616	338.5	338.5	239.0	2.616
23	71.3	68.9	227.4	227.4	161.4	2,616 2,616	227.4	227.4	161.4	2,616
24	67.4	46.R	158.1	158.1	119.6	2,616	158.1	158.1	119.6	
• '	2777									
	Sunday							H	londay	
	Tv	nical	Cooling	Chiller	Chiller	Storage Capacity (Ton-Hr)	Cooling	Chiller	Chiller	Storage
	DADE	BAMB	Load	Load	Demand	Capacity	Load	Load	Demand	Capacity
Hour	(F)	(F)	(Ton)	(Ton)	(kW)	(Ton-Hr)	(Ton)	(Ton)	(k#)	(Ton-Hr)
,,,,,,	V. 1		,							
1	67.6	65.3	0.0	375.0	349.8	2,989	0.0	375.0	349.8	2,989
2		63.9	0.0	313.3	277.5	3,300	0.0	313.3	277.5	3,300
3		62.4		0.0	0.0	3,300 3,300	0.0	0.0	0.0	3,300
4	63.7		0.0	0.0	0.0	3.300	0.0	0.0	0.0	5.300
5	63.0	60.E	0.0	0.0	0.0	3,300	0.0	0.0	0.0	3,300
6	62.8	61.2	0.0	0.0	0.0	3,300	0.0	0.0	0.0	3,300
7	63.4	61.7	0.0	0.0	0.0	3,300 3,300	0.0	0.0	0.0	3,300
8	65.1	62.3	0.0	0.0	0.0	3,300	0.0	0.0	0.0	3,300
9	67.6	63.3	220.8	220.8	147.6	3,300 3,300	220.8	220.8	147.6	3,300
10	70.7	65.2	286.9	286.9	191.2	3,300	286.9	286.9	191.2 305.8	3,300
11	74.0	67.5	432.3	432.3	305.8	3,300 3,300	432.3	432.3		3,300
12	77.1	69.8	557.6	500.0	373.0	3,242	557.6	500.0 500.0	373.0 378.5	3,242
13	79.6	71.6	535.2	500.0	378.5	3,207 3,173	535.2			
14	81.3	72.7	534.2	500.0	378.5 382.0	3,173	534.2	500.0		
15	81.8	72.8	561.4	500.0	382.3		561.4		382.3	3,112
16	81.6	73.1	609.6	500.0	382.3 383.3	3,002	609.6			3,002
17	81.0	72.7	678.8	500.0	382.0	2,823	578.8	500.0 500.0	382.0 378.5	2,823
18	80.0	71.6	665.1	500.0	378.5	2,658	655.1		3/040	2,000
19	78.7	71.3		500.0	377.6	2,658 2,616	542.0	500.0		2,616
20	77.1	72.0		496.4	376.3	2,616	496.4	496.4 448.1	376.3 331.1	2,616
21	75.3	71.8	449.1	448.1	331.1	2,616	448.1	448.1		
22	73.3		338.5	338.5	239.0	2,616	338.5	338.5	239.0	2,616
23	71.3	68.9	227.4	227.4	.161.4	2,616	227.4	227.4	161.4	2,616
24	69.4	56.8	158.1	158.1	119.6	2,616 2,616	158.1	158.1	161.4 119.6	2,616
- 1				-		•				

---- BUILDING COOLING DEMANDS. AND THERMAL STORAGE----July

				D	esign	
	Des.	ign	Cooling	Chiller	Chiller	Storage
	DADE	DAWB	Load	Load	Demand	Capacity
Hour	(F)	(F)	(Ton)	(Ton)	(k₩)	(Ton-Hr)
1	73.4	8.8	0.0	375.0	360.5	2,989
2	72.3	67.9	0.0	313.3	287.8	3,300
3	71.4	67.2	0.0	0.0	0.0	3,300
4	70.7	67.0	0.0	0.0	0.0	3,300
5	70.5	66.9	0.0	0.0	0.0	3,300
6	71.0	67.4	0.0	0.0	0.0	3,300
7	72.1	68.4	0.0	0.0	0.0	3,300
8	74.1	69.3	1.4	0.0	0.0	3,300
9	77.0	70.1	420.6	420.5	302.6	3,300
10	80.4	71.4	494.4	494.4	372.6	3,300
11	84.2	73.3	672.3	500.0	383.9	3,128
12	87.8	75.5	775.6	500.0	391.0	2,852
13	90.5	75.5	733.0	500.0	394.4	2,519
14	92.3	76.8	763.3	500.0	395.4	2,356
15	93.0	77.0	805.4	500.0	396.0	2,050
16	92.3	76.7	891.8	500.0	395.0	1,659
17	90.8	75.3	889.6	500.0	390.4	1,269
18	88.3	74.2	860.2	500.0	386.8	909
19	85.4	72.9	714.1	500.0	382.6	695
20	82.4	73.4	680.5	500.0	384.2	514
21	80.0	73.0	641.2	500.0	382.9	373
22	77.7	72.3	559.5	500.0	380.7	314
23	75.9	70.6	426.3	426.3	308.8	314
24	74.6	69.4	280.2	280.2	194.9	314

				¥e	ekday		Saturday				
	Ty	pical	Cooling	Chiller	Chiller	Storage	Cooling	Chiller	Chiller	Storage	
	DADB	DAWR	Load	Load	Demand	Capacity	Load	Load	Demand	Capacity	
Hour	(F)	(F)	(Ton)	(Ton)	{kW}	(Ton-Hr)	(Ton)	(Ton)	(k₩)	(Ton-Hr)	
1	74.3	71.0	0.0	375.0	367.5	688	0.0	375.0	367.5	1,835	
2	71.9	8.83	0.0	375.0	360.5	1,063	0.0	375.0	360.5	2,208	
3	69.9	67.0	0.0	375.0	354.9	1,437	0.0	375.0	354.9	2,582	
4	68.3	65.9	0.0	375.0	351.6	1,811	0.0	375.0	351.6	2,955	
5	67.4	65.2	0.0	375.0	349.5	2,184	0.0	347.8	318.1	3,300	
b	67.0	64.9	0.0	375.0	348.6	2,558	0.0	0.0	0.0	3,300	
7	67.5	65.3	0.0	375.0	349.8	2,931	0.0	0.0	0.0	3,300	
8	69.8	65.6	0.0	371.8	345.9	3,300	0.0	0.0	0.0	3,300	
9	70.9	65.7	248.7	248.7	167.9	3,300	248.7	248.7	167.9	3,300	
10	73.6	55.5	305.3	305.3	205.9	3,300	305.3	305.3	205.9	3,300	
11	76.7	67.9	454.0	454.0	325.6	3,300	454.0	454.0	325.6	3,300	
12	79.9	69.9	581.5	500.0	373.3	3,218	581.5	500.0	373.3	3,218	
13	83.0	71.3	563.2	500.0	377.6	3,155	563.2	500.0	377.6	3,155	

				¥e	ekday		Saturday			
	Ţvi	nical	Cooling	Chiller	Chiller	Storage	Cooling	Chiller	Chiller	Storage
	DADE		Load	Load	Demand	Capacity	Load	Load	Demand	Capacity
Hour	(F)		(Ten)	(Ton)	(kW)	(Ton-Hr)	(Ton)	(Ton)	(kW)	(Ton-Hr)
,,,,,,	٠. ١	** 1	(	( , _ , ,	•					
14	85.7	72.5	597.7	500.0	381.4	3,058	597.7	500.0	381.4	3,058
15	87.8	73.9	654.3	500.0		2,903	654.3	500.0	385.8	2,903
16	89.1	75.3	737.3		390.4	2,903 2,666	737.3	500.0	390.4	2,666
17	89.5	75.5	810.6		391.0	2,355	810.6	500.0	391.0 393.4	2,355
18	89.2	76.2	803.8	500.0	393.4	2,355 2,052	803.8	500.0	393.4	2,052
19	88.3	76.7	700.3	500.0	395.0	1,851	700.3 684.0 656.5	500.0	395.0	1,851
20	86.7	78.6	624.0	500.0	401.4	1,667	684.0	500.0	401.4	1,667
21	84.7	79.9	454.5	500.0	402.1	1,511	656.5	500.0	402.1	1,511
22	82.3	78.0	549.7	500.0	399.4	1,461	549.7	500.0	399.4	1,461
23	79.5	75.4	419.7	419.7	316.0	1,461	419.7	419.7	316.0	1,461
24	76.9	73.0	325.9	325.9	234.2	1,461 1,461 1,461	325.9	325.9	234.2	1,461
				9	unday				londay	
	Ty	pical	Cooling	Chiller	Chiller	Storage	Cooling	Chiller	Chiller	Storage
	DADE	DAWE	Load	Load	Demand	Capacity	Load	Load	Demand	Capacity
Hour	(F)	{F}	(Ton)	(Ton)	{k¥}	Storage Capacity (Ton-Hr)	(Ton)	(Ton)	(	(Ton-Hr)
1	74.3	71.0	0.0	375.0	367.5	1,835	0.0	375.0	357.5	1,835
2	71.9	68.8	0.0			2,208	0.0	375.0	360.5	2,208
3	69.9	67.0	0.0	375.0	354.9	2,582	0.0	375.0	354.9 351.6	2,582
4	68.3	65.9	0.0	375.0	351.6					2,955
5	67.4	65.2	0.0	347.8	318.1	3,300	0.0	347.8	318.1	3,300
6	67.0	64.9	0.0	0.0	0.0	3,300	0.0	0.0	0.0	
7	67.5	65.3	0.0	0.0	0.0	3,300	0.0		0.0	
8	8.36	65.6	0.0	0.0	0.0 167.9	3,300	0.0	0.0	0.0 167.9	3,300
9	70.9	65.7	248.7	248.7	167.9	3,300 3,300	248.7	248.7	167.9	3,300
10	73.6	66.5	305.3	305.3	205.9	3,300 3,300 3,218	305.3		205.9	
11	76.7	67.9	454.0	454.0	325.6	3,300	454.0	454.0	325.6	3,300
12	79.9	69.9	581.5	500.0	373.3	3,218	581.5			
13	83.0	71.3	563.2	500.0	377.6 381.4	3,155 3,058	563.2	500.0	377.6 381.4	3,155
14	25.7	72.5	597.7			3,058	597./	500.0		3,058
15	87.8	73.9	654.3		385.8	2,903 2,666 2,355	654.3		385.8	
16	89.1	75.3	737.3	500.0	390.4	2,666	737.3			
17	89.5	75.5	810.6	500.0	391.0	2,355	810.6			
18	89.2	76.2	803.8	500.0	393.4	2,052 1,851	803.8	500.0		2,052
19	88.3	76.7	700.3			1,851	700.3		373.0	1,851
20	86.7	78.6	684.0		401.4		684.0			
21	84.7	78.8	656.5	500.0	402.1	1,511 1,461	656.5	500.0		1,511
22	82.3	78.0	549.7	500.0	399.4	1,461	347.7	500.0	377.4	1,461
23	79.6	75.4		419.7	316.0	1,461	419.7	419.7 325.9	316.0 234.2	1,461
24	76.9	73.0	325.9	325.9	234.2	1,461	325.9	325.9	234.2	1,461

---- RUILDING COOLING DEMANDS AND THERMAL STORAGE----

August

			Design						
		Desi	gn	Cooling	Chiller	Chiller	Storage		
		DADB	DANE	Load	Load	Demand	Capacity		
H	our	{F}	(F)	(Ton)	(Ton)	(k#)	(Ton-Hr)		
	1	70.5	64.5	0.0	375.0	347.4	1,835		
	2	69.5	63.5	0.0	375.0	344.6	2,208		
	3	68.7	63.0	0.0	375.0	343.1	2,582		
	4	68.1	62.4	0.0	375.0	341.4	2,955		
	5	67.9	62.6	0.0	347.8	311.1	3,300		
	6	68.3	63.2	0.0	0.0	0.0	3,300		
	7	69.3	64.1	0.0	0.0	0.0	3,300		
	8	71.1	64.9	0.0	0.0	0.0	3,300		
	9	73.7	66.1	328.4	328.4	221.3	3,300		
	10	76.8	67.2	406.9	406.9	283.9	3,300		
	11	80.2	68.9	583.6	500.0	370.3	3,216		
	12	83.4	70.6	695.3	500.0	375.4	3,021		
	13	85.8	71.5	664.3	500.0	378.2	2,857		
	14	87.5	72.5	698.6	500.0	381.4	2,658		
	15	88.1	72.7	727.3	500.0	382.0	2,431		
	16	87.5	71.7	794.2	500.0	378.8	2,137		
	17	86.0	70.6	806.4	500.0	375.4	1,830		
	18	83.8	69.7	758.7	500.0	372.7	1,572		
	19	81.2	68.5	598.2	500.0	369.1	1,473		
	20	78.6	68.7	545.2	500.0	369.7	1,428		
:	21	76.4	48.8	454.4	454.4	328.4	1,428		
٠,	22	74.3	67.6	321.1	321.1	219.1	1,428		
	23	72.7	66.4	220.8	220.8	153.1	1,428		
	24	71.5	65.3	194.9	194.9	136.8	1,428		

				¥p	ekday		Saturday				
Hour	Ty DADB (F)	pical DAWB (F)	Cooling Load (Ton)	Chiller Load (Ton)	Chiller Demand (k#)	Storage Capacity (Ton-Hr)	Cooling Load (Ton)	Chiller Load (Ton)	Chiller Demand (k#)	Storage Capacity (Ton-Hr)	
1	70.1	65.3	0.0	375.0	349.8	1,802	0.0	375.0	349.8	3,159	
2	68.2	63.5	0.0	375.0	344.6	2,175	0.0	143.8	131.4	3,300	
3	66.6	62.2	0.0	375.0	340.9	2,549	0.0	0.0	0.0	3,300	
4	65.4	61.1	0.0	375.0	337.9	2,922	0.0	0.0	0.0	3,300	
5	64.6	60.7	0.0	375.0	. 336.8	3,294	0.0	0.0	0.0	3,300	
b	64.4	60.7	0.0	0.0	0.0	3,300	0.0	0.0	0.0	3,300	
7	64.9	61.2	0.0	0.0	0.0	3,300	0.0	0.0	0.0	3,300	
8	66.3	61.6	0.0	0.0	0.0	3,300	0.0	0.0	0.0	3,300	
9	68.5	62.5		178.1	123.7	3,300	178.0	178.0	123.7	3,300	
10	71.4	63.6	250.5	250.5	165.5	3,300	250.6	250.6	165.5	3,300	
	74.5	65.1	395.0	396.0	270.1	3,300	396.0	396.0	270.1	3,300	
11				500.0	364.1	3,295	504.8		364.1	3,295	
12	77.6	66.8		495.1	363.6	3,295	495.1	495.1	363.6	3,295	
13	80.5	68.2	495.1	775.4	ವರಿನ ಕಿರ	ಚಿತ್ರಮ 2 ಕೆ	11014	17614		- ,	

Trane Air Conditioning Economics By: C.D.S. MARKETING

COLD THERMAL STORAGE - ALTERNATIVE 1 8 HOUR ICE BUILD, 16 HOUR CHILLER RUN

				We	ekday		Saturday			
	Tvi	pical		Chiller	Chiller	Storage				
	DADE	DANE	Load	Load		Capacity		Load		
Hour	(F)	(F)	(Ton)				(Ton)			
,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	.,,	٠. ،	(,,,,,,,	(,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	<b>,</b> ,	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	•			
14	82.7	69.7	525.9	500.0	372.7	3,269	525.9	500.0	372.7	3,269
15	84.2	70.7	562.3	500.0	375.7	3,207	562.3	500.0	375.7	3,207
16	84.6	70.5	612.6	500.0	375.1	3,094	612.6	500.0	375.1	3,094
17	84.4	70.4	668.2	500.0	374.8	2,926	668.2	500.0	374.8	2,926
18	83.6	70.7	640.3	500.0	375.7	2,786	640.3	500.0	375.7	2,786
19	82.4	70.7	496.1	496.1	372.0	2,786	496.1	496.1	372.0	2,786
20	80.8	71.9	476.3	476.3	357.1	2,786	476.3	476.3	357.1	2,786
21	78.9	72.4	433.7	433.7	320.1	2,786	433.7	433.7	320.1	2,786
22	76.8	71.1	330.5	330.5		2,786	330.5	330.5	233.2	2,786
23	74.5	69.3	243.3	243.3		2,786	243.3		171.6	2,786
24	72.2	67.2	198.3	198.3	141.7	2,786	198.3	198.3		2,786
•	,	D	2.000		•	-,				•
				5	iunday			H	londay	
	Τγ	pical				Storage		Chiller	Chiller	Storage
	DADB	DAMB	Load	Load				Load	Demand	Capacity
Hour	(F)	(F)	(Ton)		{k¥}			(Ton)	{k\}	(Ton-Hr)
								•		
1	70.1	65.3	0.0	375.0	349.8	3,159	0.0	375.0	349.8	3,159
2	68.2	63.5	0.0	143.8	131.4	3,300	0.0	143.8	131.4	3,300
3	66.6	62.2	0.0	0.0	0.0	3,300	0.0	0.0	0.0	3,300
Ą	65.4	61.1	0.0	0.0	0.0	3,300	0.0	0.0	0.0	3,300
5	64.6	60.7	0.0	0.0	0.0	3,300	0.0	0.0	0.0	3,300
6	64.4	60.7	0.0	0.0	0.0	3,300	0.0	0.0	0.0	3,300
7	64.9	61.2	0.0	0.0	0.0	3,300	0.0	0.0	0.0	3,300
8	66.3	61.6	0.0	0.0	0.0	3,300	0.0	0.0	0.0	3,300
9	68.5	62.5	178.0	178.0	123.7	3,300	178.0	179.0	123.7	3,300
. 10	71.4	63.6	250.6	250.6	165.5	3,300	250.6	250.6	165.5	3,300
11	74.5	65.1	396.0	396.0	270.1	3,300	396.0	396.0	270.1	3,300
12	77.6	66.8	504.8	500.0	364.1	3,295	504.8	500.0	364.1	3,295
13	80.5	68.2	495.1	495.1	363:6	3,295	495.1	495.1		
14	82.7	69.7	525.9	500.0	372.7	3,269	525.9	500.0		3,269
15	84.2	70.7	562.3	500.0	375.7	3,207				3,207
16	84.6	70.5	612.6	500.0	375.1	3,094				3,094
17	84.4	70.4	668.2	500.0	374.8	2,926	658.2	500.0	374.8	2,926
18	83.6	70.7	640.3	500.0	375.7	2,786	640.3			
19	82.4	70.7	496.1	496.1	372.0	2,786	496.1	496.1	372.0	2,786
20	80.8	71.9	476.3	476.3	357.1	2,786	476.3	476.3	357.1	2,786
21	78.9	72.4	433.7	433.7	320.1	2,786	433.7			2,786
22	76.8	71.1	330.5	330.5	233.2	2,786	330.5	330.5		2,786
23	74.5	69.3	243.3	243.3	171.6	2,786	243.3	243.3		2,786
24	72.2	67.2	198.3	198.3	141.7	2,786	198.3	198.3	141.7	2,786
23	74.5	69.3	243.3	243.3	171.6	2,786	243.3	243.3		2,786

---- BUILDING COOLING DEMANDS AND THERMAL STORAGE----

September

				D	esign	
	Desi	ign	Cooling	Chiller	Chiller	Storage
	DADB	DAWR	Load	Load	Demand	Capacity
Hour	(F)	(F)	(Ton)	(Ton)	(k¥)	(Ton-Hr)
1	64.3	60.7	0.0	375.0	336.8	3,159
2	63.3	59.8	0.0	143.8	125.9	3,300
3	62.4	59.2	0.0	0.0	0.0	3,300
4	8.16	58.5	0.0	0.0	0.0	3,300
5	61.6	58.3	0.0	0.0	0.0	3,300
6	62.0	58.7	0.0	0.0	0.0	3,300
7	63.1	59.8	0.0	0.0	0.0	3,300
8	64.9	61.3	0.0	0.0	0.0	3,300
9	67.5	62.3	207.6	207.6	138.7	3,300
10	70.6	63.4	305.6	305.6	200.3	3,300
11	74.0	65.1	491.7	491.7	351.8	3,300
12	77.3	66.6	611.3	500.0	363.6	3,189
13	79.7	68.1	579.7	500.0	367.9	3,109
14	81.3	68.9	596.3	500.0	370.3	3,013
15	81.9	69.3	623.8	500.0	371.5	2,889
16	81.3	8.88	684.1	500.0	370.0	2,705
17	79.9	68.2	694.6	500.0	368.2	2,510
18	77.7	67.0	653.5	500.0	364.7	2,357
19	75.0	66.9	506.2	500.0	364.4	2,351
20	72.4	66.6	369.5	349.5	252.8	2,351
21	70.2	65.3	283.2	283.2	188.9	2,351
22	68.1	63.7	169.8	169.8	121.2	2,351
23	66.5	62.5	112.6	112.6	92.2	2,351
24	65.3	61.6	96.5	96.5	84.1	2,351

				We	ekday		Saturday			
	Ty	pical	Cooling	Chiller	Chiller	Storage	Cooling	Chiller	Chiller	Storage
	DADB	BAMB	Load	Load	Demand	Capacity	Load	Load	Demand	Capacity
Hour	(F)	(F)	(Ton)	(Ton)	(kW)	(Ton-Hr)	(Ton)	(Ton)	(kW)	(Ton-Hr)
1	63.9	61.5	0.0	375.0	339.0	2,724	0.0	68.0	81.1	3,300
2	62.0	59.7	0.0	375.0	334.1	3,096	0.0	0.0	0.0	3,300
3	60.4	58.4	0.0	206.0	170.2	3,300	0.0	0.0	0.0	3,300
4	59.2	57.1	0.0	0.0	0.0	3,300	0.0	0.0	0.0	3,300
5	58.4	56.3	0.0	0.0	0.0	3,300	0.0	0.0	0.0	3,300
6	58.2	56.1	0.0	0.0	0.0	3,300	0.0	0.0	0.0	3,300
7	58.7	56.7	0.0	0.0	0.0	3,300	0.0	0.0	0.0	3,300
8	60.1	57.9	0.0	0.0	0.0	3,300	0.0	0.0	0.0	3,300
9	62.4	58.6	79.2	79.2	75.2	3,300	79.2	79.2	75.2	3,300
10	65.2	59.6	142.2	142.2	102.8	3,300	142.9	142.9	103.1	3,300
11	68.3	61.1	275.3	275.3	176.5	3,300	275.3	275.3	176.5	3,300
12	71.5	62.7	415.0	415.0	279.9	3,300	415.0	415.0	279.9	3,300
13	74.3	64.6	413.9	413.9	283.4	3,300	414.3	414.3	283.7	3,300

Trane Air Conditioning Economics By: C.D.S. MARKETINS

				¥p	ekdav		Saturday			
	Tyr	pical	Cooling	Chiller	Chiller	Storage				
	DADE	DAME	Load	Load		Capacity			Demand	Capacity
Hour		(F)	(Ton)		(kW)	(Ton-Hr)	(Ton)		(k¥)	
14	76.6	66.0	456.6	456.6	322.9	3,300	456.6	456.6	322.8	3,300
15	78.0	67.1	465.5	465.5	333.6	3,300	465.5	465.5	333.6	3,300
16	78.5	67.5		500.0	366.2	3,285	514.5	500.0	366.2	3,285
17	78.2	67.9	550.9	500.0	367.3	3,235	550.9	500.0	367.3	3,235
18	77.5	68.0	499.0	499.0	366.7	3,235	499.0	499.0	366.7	3,235
19	76.3	69.3	379.7	379.7	267.0	3,235	379.7	379.7	267.0	3,235
20	74.7	70.0	348.0	348.0	244.0	3,235	349.0	348.0	244.0	3,235
21	72.7	69.0	290.0	290.0	200.3	3,235	290.0	290.0	200.3	3,235
22	70.6	67.3	190.0	190.0		3,235	190.0	190.0		3,235
23	68.3	65.4	121.4	121.4		3,235			99.6	3,235
24	66.1	63.6	104.2	104.2		3,235			89.6	3,235
				6	unday				londay	
	Ty	pical				Storage				Storage
	DADR	DAWE	Load	Load			_			
Hour	(F)	(F)	(Ton)		(k₩)				(k#)	(Ton-Hr)
1	63.9	61.5	0.0	68.0	81.1	3,300	0.0	69.0	81.1	3,300
2.	62.0	59.7	0.0	0.0	0.0		0.0			3,300
3	60.4	58.4	0.0	0.0	0.0	3,300	0.0			3,300
4	59.2	57.1	0.0	0.0	0.0	3,300				3,300
5	58.4	56.3	0.0	0.0	0.0	3,300	0.0		0.0	3,300
6	58.2	56.1	0.0	0.0	0.0	3,300	0.0			3,300
7	58.7	56.7	0.0	0.0	0.0	3,300	0.0			3,300
8	60.1	57.9	0.0	0.0	0.0	3,300	0.0		0.0	3,300
9	62.4	58.6	79.2	79.2		3,300	79.2			3,300
10	65.2	59.6	142.9	142.9		3,300	142.9	142.9	103.1	3,300
11	68.3	61.1	275.3	275.3	176.5	3,300	275.3	275.3	176.5	3,300
12	71.5	62.7	415.0	415.0	279.9	3,300	415.0	415.0	279.9	3,300
13	74.3	64.6	414.3	414.3	283.7	3,300	414.3	414.3		3,300
14	76.6	66.0	456.6	456.6	322.8	3,300	456.6	456.6		3,300
15	78.0	67.1	465.5	465.5	333.6	3,300	465.5			•
16	78.5	67.5	514.5	500.0	366.2	3,285				
17	78.2	67.9	550.9	500.0	367.3	3,235	550.9	500.0	367.3	3,235
18	77.5	68.0	499.0	499.0	366.7	3,235	499.0	499.0		3,235
19	76.3	69.3	379.7	379.7	267.0	3,235	379.7	379.7		3,235
20	74.7	70.0	348.0	348.0	244.0	3,235	348.0			3,235
21	72.7	69.0	290.0	290.0	200.3	3,235	290.0			3,235
21							400.0	4 DA A	177 7	7 775
22	70.6	67.3	190.0	190.0	137.3	3,235	190.0			3,235
	70.6 68.3	67.3 65.4	190.0 121.4	190.0 121.4	137.3	3,235 3,235	190.0		99.6	3,235 3,235 3,235

# ECO IT-2

---- BUILDING COOLING DEMANDS AND THERMAL STORAGE----

June

			Design							
	Desi	ign	Cooling	Chiller	Chiller	Storage				
	DADB	DAWB	Load	Load	Demand	Capacity				
Hour	(F)	(F)	(Ton)	(Ton)	(kW)	(Ton-Hr)				
i	68.7	65.1	0.0	0.0	0.0	4,000				
2	67.8	64.4	0.0	0.0	0.0	4,000				
3	67.0	63.5	0.0	0.0	0.0	4,000				
4	65.4	62.7	0.0	0.0	0.0	4,000				
5	66.3	62.7	0.0	0.0	0.0	4,000				
6	66.6	63.7	0.0	0.0	0.0	4,000				
7	67.6	64.5	0.0	0.0	0.0	4,000				
. 8	69.3	65.1	0.0	0.0	0.0	4,000				
9	71.8	66.0	0.0	0.0	0.0	4,000				
10	74.6	67.6	109.2	109.2	91.9	4,000				
11	77.8	69.8	241.8	241.8	169.6	4,000				
12	80.9	71.9	384.5	384.5	281.8	4,000				
13	83.2	73.5	353.7	353.7	259.3	4,000				
14	84.7	74.4	435.0	435.0	334.2	4,000				
15	85.3	74.6	542.1	450.0	349.3	3,908				
16	84.7	74.5	682.4	450.0	349.0	3,676				
17	83.4	73.5	806.8	450.0	346.1	3,319				
18	81.3	71.5	769.0	450.0	340.4	3,001				
19	78.8	70.1	652.3	450.0	336.5	2,798				
20	76.3	70.0	591.1	450.0	336.2	2,657				
21	74.2	69.5	546.4	450.0	334.9	2,561				
22	72.3	68.7	422.4	422.4	307.4	2,561				
23	70.8	67.1	0.0	345.0	327.4	2,904				
24	69.7	65.8	0.0	345.0	323.8	3,247				

				¥e	ekday		Saturday				
	Ty	pical	Cooling	Chiller	Chiller	Storage	Cooling	Chiller	Chiller	Storage	
	DADB	BANB	Load	Load	Demand	Capacity	Load	Load	Desand	Capacity	
Hour	(F)	<b>(F)</b>	(Ton)	(Ton)	{k₩}	(Ton-Hr)	(Ten)	(Ton)	(k₩)	(Ton-Hr)	
1	67.6	65.3	0.0	345.0	322.5	3,589	0.0	345.0	322.5	3,897	
2	66.0	63.9	0.0	345.0	318.7	3,931	0.0	106.1	103.7	4,000	
3	64.6	62.4	0.0	72.0	80.8	4,000	0.0	0.0	0.0	4,000	
4	63.7	61.3	0.0	0.0	0.0	4,000	0.0	0.0	0.0	4,000	
5	63.0	60.8	0.0	0.0	. 0.0	4,000	0.0	0.0	0.0	4,000	
6	62.8	61.2	0.0	0.0	0.0	4,000	0.0	0.0	0.0	4,000	
7	63.4	61.7	0.0	0.0	0.0	4,000	0.0	0.0	0.0	4,000	
8	65.1	62.3	0.0	0.0	0.0	4,000	0.0	0.0	0.0	4,000	
9	67.6	63.3	0.0	0.0	0.0	4,000	0.0	0.0	0.0	4,000	
10	70.7	65.2	286.9	286.9	191.4	4,000	286.9	285.9	191.5	4,000	
11	74.0	67.5	432.3	432.3	313.2	4,000	432.3	432.3	313.2	4,000	
12	77.1	69.8	557.6	450.0	335.7	3,892	557.6	450.0	335.7	3,892	
13	79.6	71.6	535.2	450.0	340.7	3,807	535.2	450.0	340.7	3,807	

Trane Air Conditioning Economics By: C.D.S. MARKETING

		Weekday Saturday								
	Tyr	pical	Conline	Chiller	Chiller	Storage				
	DADE	DAWB	Load	Load		Capacity		Load	Demand	Capacity
Hour	(F)	(F)	(Ton)			(Ton-Hr)	(Ton)		(kW)	
Hour	(1)	(1)	(1011)	(1011)	( **)	(ren m)	(7677)	(,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	,	
14	81.3	72.7	534.2	450.0	343.8	3,723	534.2	450.0	343.8	3,723
15	81.8	72.8	561.4	450.0	344.1	3,612	561.4	450.0	344,1	3,612
16	81.6	73.1	609.6	450.0	344.9	3,452	609.6	450.0	344.9	3,452
17	81.0	72.7	678.8	450.0	343.8	3,223	678.8	450.0	343.8	3,223
18	80.0	71.6	665.1	450.0	340.7	3,008	665.1	450.0	340.7	3,008
19	78.7	71.3	542.0	450.0	339.8	2,916	542.0	450.0	339.8	2,916
20	77.1	72.0	496.4	450.0	341.8	2,870	496.4	450.0	341.8	2,870
21	75.3	71.8	448.1	448.1	339.4	2,870	448.1	448.1	339.4	2,870
22	73.3	71.0	338.5	338.5		2,870	338.5	338.5	241.3	2,870
23	71.3	68.9	0.0	345.0		3,212	0.0	345.0		3,212
			0.0	345.0	326.6	3,555	0.0	345.0	326.6	3,555
24	69.4	8.88	0.0	343.0	220.0	0,000	***		22072	-,
				9	unday			H	onday	
	Tv	pical	Copling	Chiller	Chiller	Storage	Cooling	Chiller	Chiller	Storage
	DADB	DANB	Load	Load	Demand	Capacity		Load	Demand	Capacity
Hour		(F)	(Ton)		{k#}	(Ton-Hr)		(Ton)	{k#}	(Ton-Hr)
	٧. ١		,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,							
i	67.6	65.3	0.0	345.0	322.5	3,897				
2	66.0	63.9	0.0	106.1	103.7	4,000	0.0			4,000
3	64.6	62.4	0.0	0.0	0.0	4,000	0.0	0.0	0.0	4,000
4	63.7	61.3	0.0	0.0	0.0	4,000	0.0	0.0		4,000
5	63.0	60.8	0.0	0.0	0.0	4,000	0.0	0.0		4,000
6	62.8	61.2	0.0	0.0	0.0	4,000	0.0	0.0		4,000
7	63.4	61.7	0.0	0.0	0.0	4,000	0.0		0.0	4,000
8	65.1	62.3	0.0	0.0	0.0	4,000	0.0	0.0	0.0	4,000
9	67.6	63.3	0.0	0.0	0.0	4,000	0.0			4,000
10	70.7	65.2	286.9	286.9	191.5	4,000	286.9			4,000
11	74.0	67.5	432.3	432.3	313.2	4,000	432.3			4,000
12	77.1	69.8	557.6	450.0	335.7	3,892	557.6			
13	79.6	71.6	535.2	450.0	340.7	3,807				3,807
14	81.3	72.7	534.2	450.0	343.8	3,723	534.2			3,723
15	81.8	72.8	561.4	450.0	344.1	3,612				3,612
16	81.6	73.1	609.6	450.0	344.9	3,452	609.6	450.0		3,452
17	81.0	72.7	678.8	450.0	343.8	3,223	678.8			3,223
18	80.0	71.6	665.1	450.0	340.7	3,008	665.1	450.0		
19	78.7	71.3				2,916	542.0	450.0		2,916
20	77.1	72.0				2,870	496.4	450.0	341.8	2,870
21	75.3	71.8				2,870	448.1	448.1	339.4	
22	73.3	71.0				2,870	338.5	338.5	241.3	2,870
23	71.3	68.9				3,212	0.0	345.0	332.5	3,212
24	69.4	66.8				3,555	0.0	345.0	326.6	3,555
- *						-				

---- BUILDING CODLING DEMANDS AND THERMAL STORAGE----

July

			Design							
	Desi	ign	Cooling	Chiller	Chiller	Storage				
	DADB	DAWR	Load	Load	Demand	Capacity				
Hour	(F)	(F)	(Ton)	(Ton)	(kW)	(Ton-Hr)				
1	73.4	8.8	0.0	345.0	332.2	3,897				
2	72.3	67.9	0.0	106.1	108.7	4,000				
3	71.4	67.2	0.0	0.0	0.0	4,000				
4	70.7	67.0	0.0	0.0	0.0	4,000				
5	70.5	66.9	0.0	0.0	0.0	4,000				
ь	71.0	67.4	0.0	0.0	0.0	4,000				
7	72.1	68.4	0.0	0.0	0.0	4,000				
8	74.1	69.3	0.0	0.0	0.0	4,000				
9	77.0	70.1	0.0	0.0	0.0	4,000				
10	80.4	71.4	494.4	450.0	340.1	3,956				
11	84.2	73.3	672.3	450.0	345.5	3,733				
12	87.8	75.5	775.6	450.0	351.9	3,408				
13	90.5	76.5	733.0	450.0	354.9	3,125				
14	92.3	76.8	763.3	450.0	355.8	2,811				
15	93.0	77.0	805.4	450.0	356.4	2,456				
16	92.3	76.7	891.8	450.0	355.5	2,014				
17	90.8	75.3	889.6	450.0	351.3	1,575				
18	88.3	74.2	860.2	450.0	348.1	1,164				
19	85.4	72.9	714.1	450.0	344.4	900				
20	82.4	73.4	680.5	450.0	345.8	670				
21	80.0	73.0	641.2	450.0	344.6	479				
22	77.7	72.3	559.5	450.0	342.6	369				
23	75.9	70.6	0.0	345.0	337.4	714				
24	74.6	69.4	0.0	345.0	333.9	1,058				

		Weekday						Saturday				
	Typ	pical	Cooling	Chiller	Chiller	Storage	Cooling	Chiller	Chiller	Storage		
	DADB	BAMB	Load	Load	Demand	Capacity	Load	Load	Demand	Capacity		
Hour	(F)	(F)	(Ton)	(Ton)	(比算)	(Ton-Hr)	(Ton)	(Ton)	{k₩}	(Ton-Hr)		
1	74.3	71.0	0.0	345.0	338.6	1,402	0.0	345.0	338.6	2,637		
2	71.9	68.8	0.0	345.0	332.2	1,746	0.0	345.0	332.2	2,980		
3	69.9	67.0	0.0	345.0	327.1	2,090	0.0	345.0	327.1	3,323		
4	68.3	65.9	0.0	345.0	324.1	2,433	0.0	345.0	324.1	3,665		
5	67.4	65.2	0.0	345.0	-322.2	2,776	0.0	337.7	313.6	4,000		
6	67.0	64.9	0.0	345.0	321.4	3,119	0.0	0.0	0.0	4,000		
7	67.5	65.3	0.0	345.0	322.5	3,462	0.0	0.0	0.0	4,000		
8	69.8	65.6	0.0	345.0	323.3	3,804	0.0	0.0	0.0	4,000		
9	70.9	65.7	0.0	199.2	175.6	4,000	0.0	0.0	0.0	4,000		
10	73.6	66.5	305.3	305.3	206.9	4,000	305.3	305.3	206.9	4,000		
11	76.7	67.9	454.0	450.0	330.6	3,996	454.0	450.0	330.6	3,996		
12	79.9	69.9	581.5	450.0	336.0	3,864	581.5	450.0	336.0	3,864		
13	83.0	71.3	563.2	450.0	339.8	3,751	563.2	450.0	339.8	3,751		

Trane Air Conditioning Economics By: C.D.S. MARKETING

		Weekday				Saturday				
	Typ	pical	Cooling	Chiller	Chiller	Storage				
	DADB	DAWE	Load	Load						
Hour	(F)	(F)	(Ton)			(Ton-Hr)				(Ton-Hr)
14	85.7	72.5	597.7	450.0	343.2	3,604	597.7	450.0	343.2	3,604
15	87.8	73.9	654.3	450.0	347.2	3,399	654.3	450.0	347.2	3,399
16	89.1	75.3	737.3	450.0	351.3	3,112	737.3	450.0	351.3	3,112
17	89.5	75.5	810.6	450.0	351.9	2,751	810.6	450.0	351.9	2,751
18	89.2	76.2	803.8	450.0	354.0	2,398	803.8	450.0	354.0	2,398
19	88.3	76.7	700.3	450.0	355.5	2,147	700.3	450.0	355.5	2,147
20	86.7	78.6	684.0	450.0	361.3	1,913	684.0	450.0	361.3	1,913
21	84.7	78.8	656.5	450.0	361.9	1,707	656.5	450.0	361.9	1,707
22	82.3	78.0	549.7	450.0	359.5	1,607	549.7	450.0	359.5	1,607
23	79.6	75.4	0.0	345.0	351.9	1,951	0.0	345.0	351.9	1,951
24	76.9	73.0	0.0	345.0	344.6	2,294	0.0	345.0	344.6	2,294
					•				onday	
~	77	pical	-			Storage	_			Storage
	DADE	BAWB	Load	Load		Capacity		Losd		
Hour	(F)	(F)	(Ton)	(Ton)	(kW)	(Ton-Hr)	(Ton)	(Ton)	(片片)	(Ton-Hr)
	74.3	71.0	0.0	345.0	338.6	2,637	0.0	345.0	338.6	2,637
1 2	71.9	68.8	0.0	345.0	332.2	2,980	0.0	345.0		2,980
3	69.9	67.0	0.0	345.0	327.1	3,323	0.0	345.0		3,323
4	68.3	65.9			324.1	3,665	0.0	345.0		3,665
5	67.4	65.2	0.0	345.0	313.6	4,000	0.0	337.7		4,000
		64.9		337.7		4,000	0.0	0.0	0.0	4,000
6	67.0		0.0	0.0	0.0	4,000	0.0	0.0	0.0	4,000
7 8	67.5 68.8	65.3	0.0	0.0	0.0	4,000	0.0	0.0	0.0	4,000
9	70.9	65.6 65.7	0.0	0.0	0.0	4,000	0.0	0.0	0.0	4,000
10	73.6	66.5	305.3	305.3	206.9	4,000	305.3	305.3		4,000
11	76.7	67.9	454.0	450.0	330.6	3,996	454.0	450.0		3,996
12	79.9	69.9	581.5	450.0	336.0	3,864	581.5	450.0		3,864
13	83.0	71.3	563.2	450.0	339.8	3,751	563.2	450.0		3,751
14	85.7	72.5	597.7	450.0	343.2	3,604	597.7			3,604
15	87.8	73.9	654.3	450.0	347.2	3,399		450.0		3,399
16	89.1	75.3	737.3	450.0	351.3	3,112	737.3	450.0		3,112
17	89.5	75.5	810.6	450.0	351.9	2,751	810.6	450.0	351.9	2,751
19	89.2		803.8	450.0	354.0	2,398	803.8			2,398
19	88.3	76.7	700.3	450.0	355.5	2,147	700.3	450.0	355.5	2,147
20	86.7	78.6	684.0	450.0	361.3	1,913	684.0	450.0		1,913
21	84.7	78.8	656.5	450.0	361.9	1,707	656.5	450.0		1,707
22	82.3	78.0	549.7	450.0	359.5	1,607	549.7	450.0		1,607
23		75.4			351.9	1,951	0.0	345.0	351.9	1,951
23	79.6 76.9	73.0	0.0	345.0 345.0	344.6	2,294	0.0	345.0	344.6	2,294
29	10.7	12.0	0.0	343.0	344.5	2,274	V.V	070.V	J77.0	44474

---- BUILDING COOLING DEMANDS AND THERMAL STORAGE----

August

			Design					
	Desi	ign	Cooling	Chiller	Chiller	Storage		
	DADE	DAWE	Load	Load	Demand	Capacity		
Hour	(F)	{F}	(Ton)	(Ton)	(kW)	(Ton-Hr)		
1	70.5	64.5	0.0	345.0	320.3	2,637		
2	69.5	63.5	0.0	345.0	317.7	2,980		
3	68.7	63.0	0.0	345.0	316.4	3,323		
4	68.1	62.4	0.0	345.0	314.8	3,665		
5	67.9	62.6	0.0	337.7	306.9	4,000		
6	68.3	63.2	0.0	0.0	0.0	4,000		
7	69.3	64.1	0.0	0.0	0.0	4,000		
8	71.1	64.9	0.0	0.0	0.0	4,000		
9	73.7	66.1	0.0	0.0	0.0	4,000		
10	76.8	67.2	406.9	406.9	289.9	4,000		
11	80.2	68.9	583.6	450.0	333.2	3,865		
12	83.4	70.6	695.3	450.0	337.9	3,621		
13	85.8	71.5	664.3	450.0	340.4	-		
				450.0		3,407		
14 15	87.5	72.5 72.7	698.6		343.2	3,158		
	88.1		727.3	450.0	343.8	2,881		
16	87.5	71.7	794.2	450.0	341.0	2,537		
17	86.0	70.6	806.4	450.0	337.9	2,180		
18	83.8	69.7	758.7	450.0	335.4	1,872		
19	81.2	68.5	598.2	450.0	332.2	1,723		
20	78.6	69.7	545.2	450.0	332.7	1,628		
21	76.4	68.8	454.4	450.0	333.0	1,624		
22	74.3	67.6	321.1	321.1	220.8	1,624		
23	72.7	66.4	0.0	345.0	325.5	1,967		
24	71.5	65.3	0.0	345.0	322.5	2,311		

				¥e	ekday		Saturday				
	Ty	pical	Cooling	Chiller	Chiller	Storage	Cooling	Chiller	Chiller	Storage	
	DADB	DAWB	Load	Load	Demand	Capacity	Load	Load	Demand	Capacity	
Hour	(F)	(F)	(Ton)	(Ton)	(k#)	(Ton-Hr)	(Ton)	(Ton)	(k¥)	(Ton-Hr)	
1	70.1	65.3	0.0	345.0	322.5	2,654	0.0	249.7	220.1	4,000	
2	68.2	63.5	0.0	345.0	317.7	2,997	0.0	0.0	0.0	4,000	
3	66.6	62.2	0.0	345.0	314.3	3,339	0.0	0.0	0.0	4,000	
4	65.4	61.1	0.0	345.0	311.6	3,682	0.0	0.0	0.0	4,000	
5	64.6	60.7	0.0	321.2	283.6	4,000	0.0	0.0	0.0	4,000	
ė	64.4	60.7	0.0	0.0	0.0	4,000	0.0	0.0	0.0	4,000	
7	64.9	61.2	0.0	0.0	0.0	4,000	0.0	0.0	0.0	4,000	
8	66.3	61.6	0.0	0.0	0.0	4,000	0.0	0.0	0.0	4,000	
9	68.5	62.5	0.0	0.0	0.0	4,000	0.0	0.0	0.0	4,000	
10	71.4	63.6	250.5	250.5	164.5	4,000	250.6	250.6	164.5	4,000	
11	74.5	65.1	396.0	396.0	275.6	4,000	396.0	396.0	275.6	4,000	
12	77.6	66.8	504.8	450.0	327.7	3,945	504.8	450.0	327.7	3,945	
13	80.5	68.2	495.1	450.0	331.4	3.900	495.1	450.0	331.4	3,900	

Trane Air Conditioning Economics By: C.D.S. MARKETING

				We	ekday				turday	
	Ty	pical	Cooling	Chiller	Chiller	Storage	Cooling	Chiller	Chiller	Storage
	DADE	BANE	Load	Load	Demand	Capacity	Load	Load	Demand	Capacity
Hour	(F)	(F)	(Ton)	(Ton)	(kW)	(Ton-Hr)	(Ton)	(Ton)	(kW)	(Ton-Hr)
14	82.7	69.7	525.9	450.0	335.4	3,824	525.9	450.0	335.4	3,824
15	84.2	70.7	562.3	450.0	338.2	3,712	562.3	450.0	338.2	3,712
16	84.6	70.5	612.6	450.0	337.6	3,549	612.6	450.0	337.6	3,549
17	84.4	70.4	668.2	450.0	337.3	3,331	668.2	450.0	337.3	3,331
18	83.6	70.7	640.3	450.0	338.2	3,141	640.3	450.0	338.2	3,141
19	82.4	70.7	496.1	450.0	338.2	3,095	496.1	450.0	338.2	3,095
20	80.8	71.9	476.3	450.0	341.5	3,069	476.3	450.0	341.5	3,069
21	78.9	72.4	433.7	433.7	327.5	3,069	433.7	433.7	327.5	3,069
22	76.8	71.1	330.5	330.5	235.2	3,069	330.5	330.5	235.2	3,069
23	74.5	69.3	0.0	345.0	333.7	3,411	0.0	345.0		3,411
24	72.2	67.2	0.0	345.0	327.7	3,753	0.0	345.0	327.7	3,753
				,	·				londay	
	7					Storage			Chiller	
		pical	-	Load		Capacity	Load	Load		Capacity
11	DADB	DAMB	Load			(Ton-Hr)	(noT)		(k¥)	(Ton-Hr)
Hour	(F)	(F)	(Ton)	(Ton)	(k¥)	(100-01)	(1011)	(1011)	( *** )	(100: 111 )
1	70.1	65.3	0.0	249.7	220.1	4,000	0.0			4,000
2	68.2	63.5	0.0	0.0		4,000	0.0		0.0	4,000
3	66.6	62.2	0.0	0.0	0.0	4,000	0.0		0.0	4,000
4	65.4	61.1	0.0	0.0	0.0	4,000	0.0		0.0	4,000
5	64.6	60.7	0.0	0.0	0.0	4,000	0.0			4,000
6	64.4	60.7	0.0	0.0	0.0	4,000	0.0			4,000
7	64.9	61.2	0.0	0.0	0.0	4,000	0.0			4,000
8	66.3	61.6	0.0	0.0	0.0	4,000	0.0		0.0	4,000
9	68.5	62.5	0.0	0.0	0.0	4,000	0.0			4,000
. 10	71.4	63.6	250.6	250.6	164.5	4,000	250.6			4,000
11	74.5	65.1	396.0	396.0	275.6	4,000	396.0			4,000
12	77.6	66.B	504.8	450.0	327.7	3,945	504.8			3,945
13	80.5	68.2	495.1	450.0	331.4	3,900	495.1			3,900
14	82.7	69.7	525.9	450.0	335.4	3,824	525.9	450.0		3,824
15	84.2	70.7	562.3	450.0	338.2	3,712	562.3	450.0		3,712
16	84.6	70.5	612.6	450.0	337.6	3,549	612.6	450.0	337.6	3,549
17	84.4	70.4	668.2		337.3	3,331	568.2	450.0	337.3	3,331
18	83.6	70.7	640.3			3,141	640.3	450.0	338.2	3,141
19	82.4	70.7				3,095	496.1		338.2	3,095
20	80.8	71.9	476.3			3,069	476.3		341.5	3,069
21	78.9	72.4	433.7			3,069	433.7			3,069
22	76.8	71.1	330.5			3,069	330.5			3,069
23	74.5	69.3				3,411	0.0			3,411
24	72.2	67.2			'\	3,753	0.0			3,753
• '		, k	***	3.000		-,				·

#### ---- BUILDING COOLING DEMANDS AND THERMAL STORAGE----

September

			Design						
	Desi	ign	Cooling	Chiller	Chiller	Storage			
	DADE	DAWE	Load	Load	Demand	Capacity			
Hour	(F)	(F)	(Ton)	(Ton)	(kW)	(Ton-Hr)			
	12.7	10.3		240.7	210.0	4 000			
1	64.3	60.7	0.0	249.7	210.8	4,000			
2	63.3	59.8	0.0	0.0	0.0	4,000			
3	62.4	59.2	0.0	0.0	0.0	4,000			
4	61.8	58.5	0.0	0.0	0.0	4,000			
5	61.6	58.3	0.0	0.0	0.0	4,000			
6	62.0	58.7	0.0	0.0	0.0	4,000			
7	63.1	59.8	0.0	0.0	0.0	4,000			
8	64.9	61.3	0.0	0.0	0.0	4,000			
9	67.5	62.3	0.0	0.0	0.0	4,000			
10	70.6	63.4	305.6	305.6	201.5	4,000			
11	74.0	65.1	491.7	450.0	323.4	3,958			
12	77.3	66.6	611.3	450.0	327.2	3,797			
13	79.7	68.1	579.7	450.0	331.1	3,667			
14	81.3	68.9	596.3	450.0	333.2	3,521			
15	81.9	69.3	623.8	450.0	334.3	3,347			
16	81.3	68.8	684.1	450.0	333.0	3,113			
17	79.9	68.2	694.6	450.0	331.4	2,868			
18	77.7	67.0	653.5	450.0	328.2	2,665			
19	75.0	66.9	506.2	450.0	328.0	2,609			
20	72.4	66.6	369.5	369.5	256.9	2,809			
21	70.2	65.3	283.2	283.2	199.1	2,609			
22	68.1	63.7	169.8	169.8	117.9	2,609			
23	66.5	62.5	0.0	345.0	315.1	2,952			
24	65.3	61.6	0.0	345.0	312.8	3,294			

				¥e	ekday		Saturday			
	Ty	pical	Cooling	Chiller	Chiller	Storage	Cooling	Chiller	Chiller	Storage
	DADE	DAWR	Load	Load	Demand	Capacity	Load	Load	Demand	Capacity
Hour	{F}	<b>(F)</b>	(Ton)	(Ton)	{ <b>k¥</b> }	(Ton-Hr)	(Ton)	(Ton)	(kW)	(Ton-Hr)
1	63.9	61.5	0.0	345.0	312.6	3,637	0.0	0.0	0.0	4,000
2	62.0	59.7	0.0	345.0	308.2	3,979	0.0	0.0	0.0	4,000
3	60.4	58.4	0.0	24.4	41.0	4,000	0.0	0.0	0.0	4,000
4	59.2	57.1	0.0	0.0	0.0	4,000	0.0	0.0	0.0	4,000
5	58.4	56.3	0.0	0.0	0.0	4,000	0.0	0.0	0.0	4,000
6	58.2	56.1	0.0	0.0	0.0	4,000	0.0	0.0	0.0	4,000
7	58.7	56.7	0.0	0.0	0.0	4,000	0.0	0.0	0.0	4,000
8	60.1	57.9	0.0	0.0	0.0	4,000	0.0	0.0	0.0	4,000
9	62.4	58.6	0.0	0.0	0.0	4,000	0.0	0.0	0.0	4,000
10	65.2	59.6	142.2	142.2	99.2	4,000	142.9	142.9	99.5	4,000
11	68.3	61.1	275.3	275.3	176.6	4,000	275.3	275.3	176.6	4,000
12	71.5	62.7	415.0	415.0	285.6	4,000	415.0	415.0	295.5	4,000
13	74.3	64.6	413.9	413.9	290.0	4,000	414.3	414.3	290.3	4,000

Trane Air Conditioning Economics By: C.D.S. MARKETING

	#eekday						Saturday			
	Tvr	pical				Storage		Chiller	,	Storage
	DADE	DAME	Load	Load		Capacity	Load	Load	Demand	Capacity
Hour	(F)	(F)	(Ton)		(kW)	(Ton-Hr)	(Jen)	(Ton)	(k¥)	(Ton-Hr)
,,,,,,	٧٠ ١	(, )	( ,	( ,	,,	(10)	***	, ,		
14	76.6	66.0	456.6	450.0	325.7	3,993	456.6	450.0	325.7	3,993
15	78.0	67.1	465.5	450.0	328.5	3,978	465.5	450.0	328.5	3,978
16	78.5	67.5	514.5	450.0	329.5	3,913	514.5	450.0	329.5	3,913
17	78.2	67.9	550.9	450.0	330.6	3,812	550.9	450.0	330.6	3,813
18	77.5	58.0	499.0	450.0	330.9	3,764	499.0	450.0	330.9	3,764
19	76.3	69.3	379.7	379.7	271.5	3,764	379.7	379.7	271.5	3,764
20	74.7	70.0	348.0	348.0	246.8	3,764	348.0	348.0	246.8	3,764
21	72.7	69.0	290.0	290.0	200.5	3,764	290.0	290.0	200.5	3,764
22	70.6	67.3	190.0	190.0	134.2	3,764	190.0	190.0	134.2	3,764
23	68.3	65.4	0.0	239.5	210.6	4,000	0.0	239.5	210.6	4,000
24	66.1	63.6	0.0	0.0	0.0	4,000	0.0	0.0	0.0	4,000
						•				
				5	unday				londay	
	Ty	pical				Storage		Chiller	Chiller	
	DADE	DAWB	Load	Load	Demand	Capacity	Load	Load	Demand	Capacity
Hour	{F}	(F)	(Ton)	(Ton)	(k#)	(Ten-Hr)	(Ton)	(Ton)	(KB)	(Ton-Hr)
1	63.9	61.5	0.0	0.0	0.0	4,000	0.0			4,000
2	62.0	59.7	0.0	0.0	0.0	4,000	0.0			4,000
3	60.4	58.4	0.0	0.0	0.0	4,000	0.0	0.0	0.0	4,000
4	59.2	57.1	0.0	0.0	0.0	4,000	0.0	0.0	0.0	4,000
5	58.4	56.3	0.0	0.0	0.0	4,000	0.0	0.0	0.0	4,000
6	58.2	56.1	0.0	0.0	0.0	4,000	0.0	0.0	0.0	4,000
7	58.7	56.7	0.0	0.0	0.0	4,000	0.0	0.0	0.0	4,000
В	60.1	57.9	0.0	0.0	0.0	4,000	0.0	0.0	0.0	4,000
- 9	62.4	58.6	0.0	0.0	0.0	4,000	0.0	0.0	0.0	4,000
- 10	65.2	59.6	142.9	142.9	99.5	4,000	142.9			4,000
··· 11	68.3	61.1	275.3	275.3	176.6	4,000	275.3			4,000
12	71.5	62.7	415.0	415.0	286.6	4,000	415.0			4,000
13	74.3	64.6	414.3	414.3	290.3	4,000	414.3			4,000
14	76.6	66.0	456.6	450.0	325.7	3,993	456.6			3,993
15	78.0	67.1	465.5	450.0		3,978	465.5			3,978
16	78.5	67.5	514.5	450.0	329.5	3,913	514.5			3,913
17	78.2	67.9	550.9	450.0	330.6	3,813	550.9			3,813
18	77.5	68.0	499.0	450.0	330.9	3,764	499.0			3,764
19	76.3	69.3	379.7	379.7		3,764	379.7			3,764
20	74.7	70.0		348.0	246.8	3,764	348.0			3,764
21	72.7	69.0	290.0	290.0	200.5	3,764	290.0			3,764
22	70.6	67.3	190.0	190.0	134.2	3,764	190.0			3,764
23	68.3	65.4	0.0			4,000	0.0			4,000
24	56.1	63.6	0.0	0.0	0.0	4,000	0.0	0.0	0.0	4,000

# ECO IT-3

---- BUILDING COOLING DEMANDS AND THERMAL STORAGE----

June

BADB         DANB         Load         Load         Demand         Capac           1         68.7         65.1         0.0         0.0         0.0         6.           2         67.8         64.4         0.0         0.0         0.0         6.           3         67.0         63.5         0.0         0.0         0.0         6.           4         66.4         62.7         0.0         0.0         0.0         6.           5         66.3         62.7         0.0         0.0         0.0         6.           6         66.6         63.7         0.0         0.0         0.0         6.           7         67.6         64.5         0.0         0.0         0.0         6.           8         69.3         65.1         0.0         0.0         0.0         6.           9         71.8         66.0         65.3         65.3         89.9         6.           10         74.6         67.6         109.2         109.2         125.0         6.           11         77.8         69.8         241.8         241.8         192.9         6.           11         77.8				Design					
Hour (F) (F) (Ton) (Ton) (kM) (Ton-  1 68.7 65.1 0.0 0.0 0.0 0.0 6, 2 67.8 64.4 0.0 0.0 0.0 0.0 6, 3 67.0 63.5 0.0 0.0 0.0 0.0 6, 4 66.4 62.7 0.0 0.0 0.0 0.0 6, 5 66.3 62.7 0.0 0.0 0.0 0.0 6, 6 66.6 63.7 0.0 0.0 0.0 0.0 6, 7 67.6 64.5 0.0 0.0 0.0 0.0 6, 8 69.3 65.1 0.0 0.0 0.0 0.0 6, 9 71.8 66.0 65.3 65.3 89.9 6, 10 74.6 67.6 109.2 109.2 125.0 6, 11 77.8 69.8 241.8 241.8 192.9 6, 12 80.9 71.9 384.5 0.0 0.0 5, 13 83.2 73.5 353.7 0.0 0.0 5, 14 84.7 74.4 435.0 0.0 0.0 5, 15 85.3 74.6 542.1 0.0 0.0 4, 16 84.7 74.5 682.4 0.0 0.0 3, 17 83.4 73.5 806.8 0.0 0.0 2, 18 81.3 71.5 768.0 768.0 573.3 2, 19 78.8 70.1 652.3 652.3 465.8 2, 20 76.3 70.0 591.1 591.1 416.2 2, 21 74.2 69.5 546.4 546.4 380.5 2, 22 72.3 68.7 422.4 422.4 293.5		Desi	ign	Cooling	Chiller	Chiller	Storage		
1 68.7 65.1 0.0 0.0 0.0 6.0 6.0 2 67.8 64.4 0.0 0.0 0.0 0.0 6.0 6.0 6.0 6.0 6.0 6.0		DADR	DAWB	Load	Load	Demand	Capacity		
2 67.8 64.4 0.0 0.0 0.0 0.0 6, 3 67.0 63.5 0.0 0.0 0.0 0.0 6, 4 66.4 62.7 0.0 0.0 0.0 0.0 6, 5 66.3 62.7 0.0 0.0 0.0 0.0 6, 6 66.6 63.7 0.0 0.0 0.0 0.0 6, 7 67.6 64.5 0.0 0.0 0.0 0.0 6, 8 69.3 65.1 0.0 0.0 0.0 0.0 6, 9 71.8 66.0 65.3 65.3 89.9 6, 10 74.6 67.6 109.2 109.2 125.0 6, 11 77.8 69.8 241.8 241.8 192.9 6, 12 80.9 71.9 384.5 0.0 0.0 5, 13 83.2 73.5 353.7 0.0 0.0 5, 14 84.7 74.4 435.0 0.0 0.0 5, 15 85.3 74.6 542.1 0.0 0.0 3, 16 84.7 74.5 682.4 0.0 0.0 3, 17 83.4 73.5 806.8 0.0 0.0 2, 18 81.3 71.5 768.0 768.0 573.3 2, 19 78.8 70.1 652.3 652.3 465.8 2, 20 76.3 70.0 591.1 591.1 416.2 2, 21 74.2 69.5 546.4 546.4 380.5 2, 22 72.3 68.7 422.4 422.4 293.5	Hour	(F)	(F)	(Ton)	(Ton)	(kW)	(Ton-Hr)		
3 67.0 63.5 0.0 0.0 0.0 6.0 6.0 4 66.4 62.7 0.0 0.0 0.0 0.0 6.0 6.0 5 66.3 62.7 0.0 0.0 0.0 0.0 6.0 6.0 65.3 65.3 65.3 89.9 6.0 0.0 0.0 0.0 6.0 6.0 65.3 65.3 65.3 89.9 6.0 0.0 74.6 67.6 109.2 109.2 125.0 6.1 77.8 69.8 241.8 241.8 192.9 6.1 77.8 69.8 241.8 241.8 192.9 6.1 83.2 73.5 353.7 0.0 0.0 0.0 5.1 83.2 73.5 353.7 0.0 0.0 5.1 84.7 74.4 435.0 0.0 0.0 4.1 84.7 74.4 435.0 0.0 0.0 4.1 84.7 74.5 682.4 0.0 0.0 3.1 83.4 73.5 806.8 0.0 0.0 3.1 83.4 73.5 806.8 0.0 0.0 2.1 83.4 73.5 806.8 0.0 0.0 2.1 83.4 73.5 806.8 0.0 0.0 2.1 83.4 73.5 806.8 0.0 0.0 2.1 83.4 73.5 806.8 0.0 0.0 2.1 83.4 73.5 806.8 0.0 0.0 2.1 83.4 73.5 806.8 0.0 0.0 2.1 83.4 73.5 806.8 0.0 0.0 2.1 83.4 73.5 806.8 0.0 0.0 2.1 83.4 73.5 806.8 0.0 0.0 2.1 83.4 73.5 806.8 0.0 0.0 2.1 83.4 73.5 806.8 0.0 0.0 2.1 83.4 73.5 806.8 0.0 0.0 2.1 83.4 73.5 806.8 0.0 0.0 2.1 83.4 73.5 806.8 0.0 0.0 2.1 83.4 73.5 806.8 0.0 0.0 2.1 83.4 73.5 806.8 0.0 0.0 2.1 83.4 73.5 806.8 0.0 0.0 0.0 0.0 0.0 0.	1	68.7	65.1	0.0	0.0	0.0	6,000		
4 66.4 62.7 0.0 0.0 0.0 6, 5 66.3 62.7 0.0 0.0 0.0 6, 6 66.6 63.7 0.0 0.0 0.0 6, 7 67.6 64.5 0.0 0.0 0.0 0.0 6, 8 69.3 65.1 0.0 0.0 0.0 0.0 6, 9 71.8 66.0 65.3 65.3 89.9 6, 10 74.6 67.6 109.2 109.2 125.0 6, 11 77.8 69.8 241.8 241.8 192.9 6, 12 80.9 71.9 384.5 0.0 0.0 5, 13 83.2 73.5 353.7 0.0 0.0 5, 14 84.7 74.4 435.0 0.0 0.0 5, 15 85.3 74.6 542.1 0.0 0.0 4, 15 85.3 74.6 542.1 0.0 0.0 4, 16 84.7 74.5 682.4 0.0 0.0 3, 17 83.4 73.5 806.8 0.0 0.0 2, 18 81.3 71.5 768.0 768.0 573.3 2, 19 78.8 70.1 652.3 652.3 465.8 2, 20 76.3 70.0 591.1 591.1 416.2 2, 21 74.2 69.5 546.4 546.4 380.5 2, 22 72.3 68.7 422.4 422.4 293.5 2		67.8	64.4	0.0	0.0	0.0	6,000		
5       66.3       62.7       0.0       0.0       0.0       6.6         6       66.6       63.7       0.0       0.0       0.0       6.6         7       67.6       64.5       0.0       0.0       0.0       6.6         8       69.3       65.1       0.0       0.0       0.0       6.6         9       71.8       66.0       65.3       65.3       89.9       6.1         10       74.6       67.6       109.2       109.2       125.0       6.1         11       77.8       69.8       241.8       241.8       192.9       6.1         12       80.9       71.9       384.5       0.0       0.0       5.1         13       83.2       73.5       353.7       0.0       0.0       5.1         14       84.7       74.4       435.0       0.0       0.0       4.1         15       85.3       74.6       542.1       0.0       0.0       4.1         16       84.7       74.5       682.4       0.0       0.0       3.1         17       83.4       73.5       896.8       0.0       0.0       2.1         18 </td <td>3</td> <td>67.0</td> <td>63.5</td> <td>0.0</td> <td>0.0</td> <td>0.0</td> <td>6,000</td>	3	67.0	63.5	0.0	0.0	0.0	6,000		
6 66.6 63.7 0.0 0.0 0.0 6, 7 67.6 64.5 0.0 0.0 0.0 0.0 6, 8 69.3 65.1 0.0 0.0 0.0 0.0 6, 9 71.8 66.0 65.3 65.3 89.9 6, 10 74.6 67.6 109.2 109.2 125.0 6, 11 77.8 69.8 241.8 241.8 192.9 6, 12 80.9 71.9 384.5 0.0 0.0 5, 13 83.2 73.5 353.7 0.0 0.0 5, 14 84.7 74.4 435.0 0.0 0.0 5, 15 85.3 74.6 542.1 0.0 0.0 4, 15 85.3 74.6 542.1 0.0 0.0 3, 17 83.4 73.5 806.8 0.0 0.0 3, 18 81.3 71.5 768.0 768.0 573.3 2, 19 78.8 70.1 652.3 652.3 465.8 2, 20 76.3 70.0 591.1 591.1 416.2 2, 21 74.2 69.5 546.4 546.4 380.5 2, 22 72.3 68.7 422.4 422.4 293.5	4	66.4	62.7	0.0	0.0	0.0	6,000		
7 67.6 64.5 0.0 0.0 0.0 6.0 6.0 8 69.3 65.1 0.0 0.0 0.0 0.0 6.0 6.0 9 71.8 66.0 65.3 65.3 89.9 6.10 74.6 67.6 109.2 109.2 125.0 6.11 77.8 69.8 241.8 241.8 192.9 6.12 80.9 71.9 384.5 0.0 0.0 5.13 83.2 73.5 353.7 0.0 0.0 5.14 84.7 74.4 435.0 0.0 0.0 5.15 85.3 74.6 542.1 0.0 0.0 4.15 85.3 74.6 542.1 0.0 0.0 4.15 84.7 74.5 682.4 0.0 0.0 3.17 83.4 73.5 806.8 0.0 0.0 2.18 81.3 71.5 768.0 768.0 573.3 2.19 78.8 70.1 652.3 652.3 465.8 2.2 72.3 68.7 422.4 422.4 293.5 2.5 22 72.3 68.7 422.4 422.4 293.5 2.5 2.5 2.5 2.5 2.5 2.5 2.5 2.5 2.5 2	5	66.3	62.7	0.0	0.0	0.0	6,000		
8       69.3       65.1       0.0       0.0       0.0       6.0         9       71.8       66.0       65.3       65.3       89.9       6.0         10       74.6       67.6       109.2       109.2       125.0       6.0         11       77.8       69.8       241.8       241.8       192.9       6.0         12       80.9       71.9       384.5       0.0       0.0       5.0         13       83.2       73.5       353.7       0.0       0.0       5.0         14       84.7       74.4       435.0       0.0       0.0       4.0         15       85.3       74.6       542.1       0.0       0.0       4.0         15       85.3       74.6       542.1       0.0       0.0       4.0         16       84.7       74.5       682.4       0.0       0.0       3.0         17       83.4       73.5       806.8       0.0       0.0       2.0         18       81.3       71.5       768.0       768.0       573.3       2.0         19       78.8       70.1       652.3       652.3       465.8       2.0 <t< td=""><td>6</td><td>66.6</td><td>63.7</td><td>0.0</td><td>0.0</td><td>0.0</td><td>6,000</td></t<>	6	66.6	63.7	0.0	0.0	0.0	6,000		
9       71.8       66.0       65.3       65.3       89.9       6,         10       74.6       67.6       109.2       109.2       125.0       6,         11       77.8       69.8       241.8       241.8       192.9       6,         12       80.9       71.9       384.5       0.0       0.0       5,         13       83.2       73.5       353.7       0.0       0.0       5,         14       84.7       74.4       435.0       0.0       0.0       4,         15       85.3       74.6       542.1       0.0       0.0       4,         16       84.7       74.5       682.4       0.0       0.0       3,         17       83.4       73.5       806.8       0.0       0.0       2,         18       81.3       71.5       768.0       768.0       573.3       2,         19       78.8       70.1       652.3       652.3       465.8       2,         20       76.3       70.0       591.1       591.1       416.2       2,         21       74.2       69.5       546.4       546.4       380.5       2	7	67.6	64.5	0.0	0.0	0.0	6,000		
10       74.6       67.6       109.2       109.2       125.0       6         11       77.8       69.8       241.8       241.8       192.9       6         12       80.9       71.9       384.5       0.0       0.0       5         13       83.2       73.5       353.7       0.0       0.0       5         14       84.7       74.4       435.0       0.0       0.0       4         15       85.3       74.6       542.1       0.0       0.0       4         16       84.7       74.5       682.4       0.0       0.0       3         17       83.4       73.5       806.8       0.0       0.0       2         18       81.3       71.5       768.0       768.0       573.3       2         19       78.8       70.1       652.3       652.3       465.8       2         20       76.3       70.0       591.1       591.1       416.2       2         21       74.2       69.5       546.4       546.4       380.5       2         22       72.3       68.7       422.4       422.4       293.5       2 <td>8</td> <td>69.3</td> <td>65.1</td> <td>0.0</td> <td>0.0</td> <td>0.0</td> <td>6,000</td>	8	69.3	65.1	0.0	0.0	0.0	6,000		
11       77.8       69.8       241.8       241.8       192.9       6         12       80.9       71.9       384.5       0.0       0.0       5         13       83.2       73.5       353.7       0.0       0.0       5         14       84.7       74.4       435.0       0.0       0.0       4         15       85.3       74.6       542.1       0.0       0.0       4         16       84.7       74.5       682.4       0.0       0.0       3         17       83.4       73.5       806.8       0.0       0.0       2         18       81.3       71.5       768.0       768.0       573.3       2         19       78.8       70.1       652.3       652.3       465.8       2         20       76.3       70.0       591.1       591.1       416.2       2         21       74.2       69.5       546.4       546.4       380.5       2         22       72.3       68.7       422.4       422.4       293.5       2	. 9	71.8	66.0	65.3	65.3	89.9	6,000		
12 80.9 71.9 384.5 0.0 0.0 5 13 83.2 73.5 353.7 0.0 0.0 5 14 84.7 74.4 435.0 0.0 0.0 4 15 85.3 74.6 542.1 0.0 0.0 4 16 84.7 74.5 682.4 0.0 0.0 3 17 83.4 73.5 806.8 0.0 0.0 2 18 81.3 71.5 768.0 768.0 573.3 2 19 78.8 70.1 652.3 652.3 465.8 2 20 76.3 70.0 591.1 591.1 416.2 2 21 74.2 69.5 546.4 546.4 380.5 2 22 72.3 68.7 422.4 422.4 293.5 2	10	74.6	67.6	109.2	109.2	125.0	6,000		
12 80.9 71.9 384.5 0.0 0.0 5.1 13 83.2 73.5 353.7 0.0 0.0 5.1 14 84.7 74.4 435.0 0.0 0.0 0.0 4.1 15 85.3 74.6 542.1 0.0 0.0 0.0 4.1 16 84.7 74.5 682.4 0.0 0.0 0.0 17 83.4 73.5 806.8 0.0 0.0 2.1 18 81.3 71.5 768.0 768.0 573.3 2.1 19 78.8 70.1 652.3 652.3 465.8 2.1 20 76.3 70.0 591.1 591.1 416.2 2.1 74.2 69.5 546.4 546.4 380.5 2.1 74.2 69.5 546.4 546.4 546.4 546.4 546.4 546.4 546.4 546.4 546.4 546.4 546.4 546.4 546.4 546.4 546.4 546.4 546.4 546	11	77.8	69.8	241.8	241.8	192.9	6,000		
13 83.2 73.5 353.7 0.0 0.0 5.1   14 84.7 74.4 435.0 0.0 0.0 0.0 4.1   15 85.3 74.6 542.1 0.0 0.0 4.1   16 84.7 74.5 682.4 0.0 0.0 3.1   17 83.4 73.5 806.8 0.0 0.0 2.1   18 81.3 71.5 768.0 768.0 573.3 2.1   19 78.8 70.1 652.3 652.3 465.8 2.1   20 76.3 70.0 591.1 591.1 416.2 2.1 74.2 69.5 546.4 546.4 380.5 2.1 74.2 69.5 546.4 546.4 546.4 546.4 546.4 546.4 546.4 546.4 546.4 546.4 54	12	80.9	71.9	384.5	0.0	0.0	5,611		
15 85.3 74.6 542.1 0.0 0.0 4 16 84.7 74.5 682.4 0.0 0.0 3 17 83.4 73.5 806.8 0.0 0.0 2 18 81.3 71.5 768.0 768.0 573.3 2 19 78.8 70.1 652.3 652.3 465.8 2 20 76.3 70.0 591.1 591.1 416.2 2 21 74.2 69.5 546.4 546.4 380.5 2 22 72.3 68.7 422.4 422.4 293.5 2	13	83.2	73.5	353.7	0.0	0.0	5,252		
15 85.3 74.6 542.1 0.0 0.0 4 16 84.7 74.5 682.4 0.0 0.0 3 17 83.4 73.5 806.8 0.0 0.0 2 18 81.3 71.5 768.0 768.0 573.3 2 19 78.8 70.1 652.3 652.3 465.8 2 20 76.3 70.0 591.1 591.1 416.2 2 21 74.2 69.5 546.4 546.4 380.5 2 22 72.3 68.7 422.4 422.4 293.5 2	14	84.7	74.4	435.0	0.0	0.0	4,813		
16     84.7     74.5     682.4     0.0     0.0     3       17     83.4     73.5     896.8     0.0     0.0     2       18     81.3     71.5     768.0     768.0     573.3     2       19     78.8     70.1     652.3     652.3     465.8     2       20     76.3     70.0     591.1     591.1     416.2     2       21     74.2     69.5     546.4     546.4     380.5     2       22     72.3     68.7     422.4     422.4     293.5     2	15	85.3	74.6	542.1	0.0	0.0	4,267		
17 83.4 73.5 806.8 0.0 0.0 2 18 81.3 71.5 768.0 768.0 573.3 2 19 78.8 70.1 652.3 652.3 465.8 2 20 76.3 70.0 591.1 591.1 416.2 2 21 74.2 69.5 546.4 546.4 380.5 2 22 72.3 68.7 422.4 422.4 293.5 2	16	84.7	74.5	682.4	0.0	0.0	3,582		
18     81.3     71.5     768.0     768.0     573.3     2       19     78.8     70.1     652.3     652.3     465.8     2       20     76.3     70.0     591.1     591.1     416.2     2       21     74.2     69.5     546.4     546.4     380.5     2       22     72.3     68.7     422.4     422.4     293.5     2	17	83.4	73.5	806.8	0.0	0.0	2,772		
19 78.8 70.1 652.3 652.3 465.8 2 20 76.3 70.0 591.1 591.1 416.2 2 21 74.2 69.5 546.4 546.4 380.5 2 22 72.3 68.7 422.4 422.4 293.5 2	18	81.3	71.5	768.0	768.0	573.3	2,772		
21 74.2 69.5 546.4 546.4 380.5 2 22 72.3 68.7 422.4 422.4 293.5 2	19	78.8	70.1	652.3	652.3	465.8	2,772		
F- 22 72.3 68.7 422.4 422.4 293.5 2	20	76.3	70.0	591.1	591.1	416.2	2,772		
	21	74.2	69.5	546.4	546.4	380.5	2,772		
	22	72.3	68.7	422.4	422.4	293.5	2,772		
	23	70.8	67.1	246.2	246.2	189.3	2,772		
<b>24 69.7 65.8 170.5 170.5 149.8 2</b>	24	69.7	65.8	170.5	170.5	149.8	2,772		

				¥e	ekday	Saturday				
	Ty	pical	Cooling	Chiller	Chiller	Storage	Cooling	Chiller	Chiller	Storage
	DADB	DAWB	Load	Load	Demand	Capacity	Load	Load	Demand	Capacity
Hour	(F)	(F)	(Ton)	(Ton)	(k#)	(Ton-Hr)	(Ton)	(Ton)	(kW)	(Ton-Hr)
1	67.6	65.3	0.0	625.0	584.5	3,395	0.0	625.0	584.5	3,124
2	66.0	63.9	0.0	625.0	577.8	4,017	0.0	625.0	577.8	3,747
3	64.6	62.4	0.0	625.0	570.7	4,639	0.0	625.0	570.7	4,369
4	63.7	61.3	0.0	625.0	.565.7	5,260	0.0	625.0	565.7	4,990
5	63.0	60.8	0.0	625.0	563.5	5,881	0.0	625.0	563.5	5,611
ė	62.8	61.2	0.0	123.9	140.5	6,000	0.0	393.4	330.8	6,000
7	63.4	61.7	0.0	0.0	0.0	6,000	0.0	0.0	0.0	6,000
9	65.1	62.3	0.0	0.0	0.0	6,000	0.0	0.0	0.0	5,000
9	67.6	63.3	220.8	220.8	169.8	6,000	220.8	220.8	168.8	6,000
10	70.7	65.2	286.9	286.9	206.1	6,000	286.9	286.9	206.1	6,000
11	74.0	67.5	432.3	432.3	295.5	6,000	432.3	432.3	295.5	6,000
12	77.1	69.8	557.6	0.0	0.0	5,438	557.6	0.0	0.0	5,438
13	79.6	71.6	535.2	0.0	0.0	4,898	535.2	0.0	0.0	4,898

Trane Air Conditioning Economics By: C.D.S. MARKETING

				Ne	ekdav		Saturday			
	Ty	pical				Storage			•	Storage
	DADB	DAMB	Load	Load		Capacity		Load		Capacity
Hour	(F)	(F)	(Ton)			(Ton-Hr)		(Ton)	(kW)	(Ton-Hr)
14	81.3	72.7	534.2	0.0	0.0	4,360	534.2	0.0	0.0	4,360
15	81.8	72.8	561.4	0.0	0.0	3,795	561.4	0.0	0.0	3,795
16	81.6	73.1	609.6	0.0	0.0	3,182	609.6	0.0	0.0	3,192
17	81.0	72.7	678.8	0.0	0.0	2,501	678.8	0.0	0.0	2,501
18	80.0	71.6	665.1	665.1	482.6	2,501	665.1	665.1	482.6	2,501
19	78.7	71.3	542.0	542.0	383.5	2,501	542.0	542.0	383.5	2,501
20	77.1	72.0	496.4	496.4	353.5	2,501	496.4		353.5	2,501
21	75.3	71.8	448.1	448.1	326.4	2,501	448.1	448.1	320.4	2,501
22	73.3	71.0	338.5	338.5	249.7	2,501	338.5	338.5	249.7	2,501
23	71.3	68.9	227.4	227.4	183.5	2,501	227.4	227.4	183.5	2,501
24	69.4	66.8	158.1	158.1	145.7	2,501	158.1	15B.1	145.7	2,501
				6					londay	
	. Tv	pical				Storage			Chiller	
	BADE	CAMB	Load	Load			_	Load		
Hour	(F)	(F)	(Ton)		(kW)					
กมนา	(1)	(1.1	(1011)	(1011)	/ K# /	(100-10)	(1011)		( *** }	(101:11:7
1	67.6	65.3	0.0	625.0	584.5	3,124	0.0	625.0	584.5	3,124
2	66.0	63.9	0.0	625.0	577.8	3,747	0.0	625.0	577.8	3,747
3	64.6	62.4	0.0	625.0	570.7	4,369	0.0	625.0	570.7	4,369
4	63.7	61.3	0.0	625.0	565.7	4,990	0.0	625.0	565.7	4,990
5	63.0	60.8	0.0	625.0	563.5	5,611	0.0	625.0	563.5	5,611
Ь	62.8	61.2	0.0	393.4	330.8	6,000	0.0	393.4	330.8	6,000
7	63.4	61.7	0.0	0.0	0.0	6,000	0.0	0.0	0.0	6,000
В	65.1	62.3	0.0	0.0	0.0	6,000	0.0	0.0	0.0	6,000
. 9	67.6	63.3	220.8	220.8	168.8	6,000	220.8		168.8	6,000
. 10	70.7	65.2	286.9	286.9		6,000	286.9		206.1	6,000
11	74.0	67.5	432.3	432.3	295.5	6,000	432.3			6,000
12	77.1	69.8	557.6	0.0	0.0	5,438	557.6		0.0	5,438
13	79.6	71.6	535.2	0.0	0.0	4,898	535.2			4,898
14	81.3	72.7	534.2	0.0	0.0	4,360				4,360
15	81.8	72.8	561.4			3,795				3,795
16	81.6	73.1	609.6	0.0	0.0	3,182				3,182
17	81.0	72.7	678.8	0.0	0.0	2,501	678.8	0.0		2,501
18	80.0				482.6	2,501				2,501
19	78.7	71.3	542.0	542.0	383.5	2,501	542.0			2,501
20	77.1	72.0	496.4	496.4		2,501	496.4			2,501
21	75.3	71.8	448.1	448.1		2,501	448.1		320.4	
22	73.3	71.0	338.5	338.5	249.7	2,501	338.5			2,501
23	71.3	68.9	227.4	227.4		2,501	227.4			2,501
23 24	69.4	66.8	158.1	158.1	145.7	2,501	158.1	158.1	145.7	2,501
24	27.4	00.0	130.1	100.1	143.7	2,301	140.1	140.1	170.1	2,001

---- BUILDING COOLING DEMANDS AND THERMAL STBRAGE----

July

		Design						
		Desi	ign	Cooling	Chiller	Chiller	Storage	
		DADB	BAWB	Load	Load	Demand	Capacity	
H	lour	(F)	(F)	(Ton)	(Ton)	(kW)	(Ton-Hr)	
	1	73.4	68.8	0.0	625.0	602.2	3,124	
	2	72.3	67.9	0.0	625.0	597.5	3,747	
	3	71.4	67.2	0.0	625.0	594.0	4,369	
	4	70.7	67.0	0.0	625.0	593.0	4,990	
	5		66.9	0.0	625.0	592.5	5,611	
		70.5	-		393.4	352.3		
	6	71.0	67.4	0.0			6,000	
	7	72.1	68.4	0.0	0.0	0.0	6,000	
	8	74.1	69.3	1.4	0.0	0.0	6,000	
	9	77.0	70.1	420.6	420.6	297.0	6,000	
	10	80.4	71.4	494.4	494.4	349.9	6,000	
	11	84.2	73.3	672.3	672.3	496.1	6,000	
	12	87.8	75.5	775.6	0.0	0.0	5,220	
	13	90.5	76.5	733.0	0.0	0.0	4,483	
	14	92.3	76.8	763.3	0.0	0.0	3,716	
	15	93.0	77.0	805.4	0.0	0.0	2,907	
	16	92.3	76.7	891.8	0.0	0.0	2,013	
	17	90.8	75.3	889.6	0.0	0.0	1,122	
	18	88.3	74.2	860.2	810.0	625.6	1,072	
	19	85.4	72.9	714.1	714.1	530.9	1,072	
	20	82.4	73.4	680.5	680.5	503.6	1,072	
-		80.0	73.0	641.2	641.2	468.4	1,072	
	22	77.7	72.3	559.5	559.5	400.3	1,072	
-		75.9	70.6	426.3	426.3	302.2	1,072	
	24	74.6	69.4	280.2	280.2	212.6	1,072	
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				¥e	ekday		Saturday			
	Ty	pical	Cooling	Chiller	Chiller	Storage	Cooling	Chiller	Chiller	Storage
	DADB	DANE	Load	Load	Demand	Capacity	Load	Load	Demand	Capacity
Hour	(F)	(F)	(Ton)	(Ton)	(k₩)	(Ton-Hr)	(Ton)	(Ton)	(kW)	(Ton-Hr)
1	74.3	71.0	0.0	625.0	613.7	1,696	0.0	625.0	613.7	2,657
2	71.9	8.83	0.0	625.0	602.2	2,319	0.0	625.0	602.2	3,280
3	69.9	67.0	0.0	625.0	593.0	2,943	0.0	625.0	593.0	3,902
4	48.3	65.9	0.0	625.0	587.5	3,565	0.0	625.0	587.5	4,524
5	67.4	65.2	0.0	625.0	584.0	4,187	0.0	625.0	584.0	5,146
6	67.0	64.9	0.0	625.0	582.6	4,309	0.0	625.0	582.6	5,767
7	67.5	65.3	0.0	625.0	584.5	5,430	0.0	238.1	222.6	6,000
8	68.8	65.6	0.0	574.1	527.1	6,000	0.0	0.0	0.0	6,000
9	70.9	65.7	248.7	248.7	187.5	6,000	248.7	248.7	187.6	6,000
10	73.6	65.5	305.3	305.3	219.1	6,000	305.3	305.3	219.1	6,000
11	76.7	67.9	454.0	454.0	310.6	6,000	454.0	454.0	310.6	6,000
12	79.9	69.9	581.5	0.0	0.0	5,414	581.5	0.0	0.0	5,414
13	83.0	71.3	563.2	0.0	0.0	4,846	563.2	0.0	0.0	4,846

Trane Air Conditioning Economics By: C.D.S. MARKETING

				Nec	ekdav		Saturday			
	Typ	ical	Copling	Chiller	Chiller	Storage	Cooling	Chiller	Chiller	Storage
	DADB	DANE	Load	Load		Capacity		Load	Demand	Capacity
Hour		{F}		(Ton)		(Ton-Hr)		(Ton)	(kW)	(Ten-Hr)
	<b></b>		(,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	*****		•				
14	85.7	72.5	597.7	0.0	0.0	4,245	597.7	0.0	0.0	4,245
15	87.8	73.9	654.3	0.0	0.0	3,587	654.3	0.0	0.0	3,597
16	89.1	75.3	737.3	0.0	0.0	2,847	737.3	0.0	0.0	2,847
17	89.5	75.5	810.6	0.0	0.0	2,034	810.6	0.0	0.0	2,034
18	89.2	76.2	803.8	803.8	631.1	2,034	803.8	803.8	631.1	2,034
19	88.3	76.7	700.3	700.3	536.1	2,034	700.3	700.3	536.1	2,034
20	86.7	78.6	684.0	684.0		2,034	684.0	684.0	530.1	2,034
21	84.7	78.8	656.5	656.5		2,034	656.5	656.5		2,034
22	82.3	78.0	549.7		416.3	2,034	549.7	549.7	416.3	2,034
23	79.6	75.4	419.7		313.8	2,034		419.7	313.8	2,034
24	76.9	73.0	325.9		247.6	2,034		325.9	247.6	2,034
						•				
				S	unday				onday	
	Ty	pical				Storage	Cooling	Chiller	Chiller	Storage
	DADB	DANB	Load	Load		Capacity			Demand	
Hour	(F)	(F)	(Ton)		(kW)	(Ton-Hr)	(Ton)	(Ton)	(kW)	(Ton-Hr)
								•		
1	74.3	71.0	0.0	625.0	613.7	2,657	0.0			
2	71.9	8.88	0.0	625.0	602.2	3,280	0.0	625.0		3,280
3	69.9	67.0	0.0	625.0	593.0	3,902	0.0	625.0		3,902
4	68.3	65.9	0.0	625.0	587.5	4,524	0.0	625.0		4,524
5	67.4	65.2	0.0	625.0	584.0	5,146	0.0	625.0		5,146
6	67.0	64.9	0.0	625.0	582.6	5,767	0.0	625.0		5,767
7	67.5	65.3	0.0	238.1	222.6	6,000	0.0	238.1	222.6	6,000
. 8	68.8	65.6	0.0		0.0	6,000	0.0	0.0		6,000
9	70.9	65.7	248.7		187.6	6,000	248.7	248.7		
10	73.6	66.5	305.3		219.1	6,000	305.3	305.3		6,000
. 11	75.7	67.9	454.0		310.6	6,000	454.0	454.0	310.6	6,000
12	79.9	69.9	581.5	0.0	0.0	5,414	581.5	0.0	0.0	5,414
13	83.0	71.3	563.2	0.0	0.0	4,846	563.2			4,846
14	85.7	72.5	597.7	0.0	0.0	4,245	597.7			4,245
15	87.8	73.9	654.3	0.0	0.0	3,587	654.3			3,587
16	89.1	75.3			0.0	2,847	737.3	0.0		2,847
17	89.5	75.5	810.6	0.0	0.0	2,034	810.6	0.0		2,034
18		76.2			631.1	2,034	803.8	803.8	631.1	2,034
19	88.3	76.7				2,034	700.3			2,034
20	86.7	78.6				2,034	684.0	684.0	530.1	2,034
21	84.7	78.8						656.5	506.4	2,034
22	82.3	78.0							416.3	2,034
23	79.6	75.4				2,034	419.7			2,034
24	76.9	73.0				2,034	325.9			2,034
± 7	, ,				• =	-,				•

### ---- BUILDING COOLING DEMANDS AND THERMAL STORAGE----

August

					D	esign	
		Desi	ign	Cooling	Chiller	Chiller	Storage
		DADB	DAWB	Load	Load	Demand	Capacity
H	our	(F)	(F)	(Ton)	(Ton)	(kW)	(Ton-Hr)
	1	70.5	64.5	0.0	625.0	580.6	2,657
	2	69.5	63.5	0.0	625.0	575.9	3,280
	3	48.7	63.0	0.0	625.0	573.5	3,902
	4	63.1	62.4	0.0	625.0	570.7	4,524
	5	67.9	62.6	0.0	625.0	571.6	5,146
	6	68.3	63.2	0.0	625.0	574.4	5,767
	7	69.3	64.1	0.0	238.1	219.5	6,000
	8	71.1	64.9	0.0	0.0	0.0	6,000
	9	73.7	66.1	328.4	328.4	230.7	6,000
	10	76.8	67.2	406.9	406.9	279.1	6,000
	11	80.2	68.9	583.6	583.6	406.3	6,000
	12	83.4	70.6	695.3	0.0	0.0	5,300
	13	85.8	71.5	664.3	0.0	0.0	4,631
	14	87.5	72.5	698.6	0.0	0.0	3,929
	15	88.1	72.7	727.3	0.0	0.0	3,199
	16	87.5	71.7	794.2	0.0	0.0	2,402
	17	86.0	70.6	806.4	0.0	0.0	1,593
	18	83.8	69.7	758.7	758.7	556.3	1,593
	19	81.2	68.5	598.2	598.2	416.2	1,593
	20	78.6	68.7	545.2	545.2	376.8	1,593
•	21	76.4	68.B	454.4	454.4	313.9	1,593
	22	74.3	67.6	321.1	321.1	230.6	1,593
182 °	23	72.7	65.4	220.8	220.8	175.1	1,593
	24	71.5	65.3	194.9	194.9	160.3	1,593

				NE	ekday	Saturday				
	Ty	pical	Cooling	Chiller	Chiller	Storage	Cooling	Chiller	Chiller	Storage
	DADB	DAWB	Load	Load	Demand	Capacity	Load	Load	Demand	Capacity
Hour	(F)	(F)	(Ton)	(Ton)	(k#)	(Ten-Hr)	(Ton)	(Ton)	(比量)	(Ton-Hr)
1	70.1	65.3	0.0	625.0	584.5	2,217	0.0	625.0	584.5	3,232
2	68.2	63.5	0.0	625.0	575.9	2,840	0.0	625.0	575.9	3,854
3	66.6	62.2	0.0	625.0	569.8	3,463	0.0	625.0	569.8	4,476
4	65.4	61.1	0.0	625.0	564.8	4,085	0.0	625.0	564.8	5,097
5	64.6	60.7	0.0	825.0	-563.1	4,707	0.0	625.0	563.1	5,718
6	64.4	60.7	0.0	625.0	563.1	5,328	0.0	286.3	244.1	5,000
7	64.9	61.2	0.0	625.0	565.3	5,949	0.0	0.0	0.0	6,000
8	66.3	61.6	0.0	55.7	95.4	6,000	0.0	0.0	0.0	6,000
9	68.5	62.5	178.1	178.1	147.4	6,000	178.0	178.0	147.4	6,000
10	71.4	63.6	250.5	250.5	183.9	6,000	250.6	250.6	183.9	6,000
11	74.5	65.1	396.0	396.0	266.1	6,000	396.0	396.0	266.1	6,000
12	77.6	66.8	504.8	0.0	0.0	5,490	504.8	0.0	0.0	5,490
13	80.5	68.2	495.1	0.0	0.0	4,991	495.1	0.0	0.0	4,991

Trane Air Conditioning Economics By: C.D.S. MARKETING

								Saturday			
					We	ekday					
			pical				Storage			Chiller	
		BADR	DAMB	Load	Load	Demand	Capacity		Load	Demand	Capacity
Но	ur	{F}	(F)	(Ton)	(Ten)	(kW)	(Ton-Hr)	(Ton)	(Ton)	(kW)	(Ton-Hr)
	14	82.7	69.7	525.9	0.0	0.0	4,461	525.9		0.0	4,461
	15	84.2	70.7	562.3	0.0	0.0	3,895	562.3	0.0	0.0	3,895
	16	84.6	70.5	612.6	0.0	0.0	3,279	612.6	0.0	0.0	3,279
	17	84.4	70.4	668.2	0.0	0.0	2,609	668.2	0.0	0.0	2,609
	18	83.6	70.7	640.3	640.3	458.3	2,609	640.3	640.3	458.3	2,609
	19	82.4	70.7	496.1	496.1	348.3	2,609	496.1	496.1	348.3	2,609
	20	80.8	71.9	476.3	476.3	339.5	2,609	476.3	476.3	339.5	2,609
	21	78.9	72.4	433.7	433.7	313.0	2,609	433.7	433.7	313.0	2,609
	22	76.8	71.1	330.5	330.5	245.3	2,609	330.5	330.5	245.3	2,609
	23	74.5	69.3	243.3	243.3	192.6	2,609	243.3	243.3	192.6	2,609
	24	72.2	67.2	198.3	198.3	165.6	2,609	198.3	198.3	165.6	2,609
•					5	ionday			}	onday	
		Ty:	pical		Chiller		Storage	Cooling		Chiller	Storage
		DADB	DAMB	Load	Load	Demand	Capacity	Load	Load		
Ho	our	{F}	(F)	(Ton)	(Ton)	(k#)	(Ton-Hr)	(Ton)	(Ton)	(k#)	(Ton-Hr)
	1	70.1	65.3	0.0	625.0	584.5	3,232	0.0	625.0	584.5	3,232
	2	68.2	63.5	0.0	625.0		3,854	0.0	625.0		3,854
	3	66.6	62.2	0.0	625.0		4,476	0.0	625.0		4,476
	4	65.4	61.1	0.0	625.0		5,097	0.0	625.0		5,097
	5	64.6	60.7	0.0	625.0		5,718	0.0	625.0		5,718
	6	64.4	60.7	0.0	286.3		6,000	0.0	286.3		6,000
•	7	64.9	61.2	0.0	0.0		6,000	0.0	0.0		6,000
	8	66.3	61.6	0.0	0.0		6,000	0.0	0.0		6,000
	9	68.5	62.5	178.0	178.0		5,000	178.0	178.0		5,000
	10	71.4	63.6	250.6	250.6		6,000	250.6	250.6	183.9	6,000
	11	74.5	65.1	396.0			6,000	396.0	396.0	266.1	6,000
	12	77.6	66.8	504.8			5,490	504.8	0.0	0.0	5,490
	13	80.5	68.2	495.1	0.0		4,991	495.1	0.0	0.0	4,991
	14	82.7	69.7	525.9			4,461	525.9		0.0	4,461
	15	84.2	70.7	562.3			3,895	562.3	0.0	0.0	3,895
	16	84.6	70.5	612.6			3,279		0.0	0.0	3,279
	17	84.4	70.4	668.2			2,609	668.2	0.0	0.0	2,609
	18	83.6	70.7				2,609	640.3	640.3	458.3	2,609
	19	82.4	70.7				2,609	496.1	496.1	348.3	2,609
	20	80.8	71.9				2,609	476.3	476.3	339.5	2,609
	21	78.9	72.4	433.7			2,609	433.7			2,609
	22	76.8	71.1	330.5			2,609	330.5		245.3	2,609
	23	74.5	69.3				2,609	243.3		192.5	2,609
	24	72.2	67.2				2,609	198.3		165.6	2,609

#### ---- BUILDING COOLING DEMANDS AND THERNAL STORAGE----

September

			Design					
	Desi	ign	Cooling	Chiller	Chiller	Storage		
	DADB	BWAG	Load	Load	Demand	Capacity		
Hour	(F)	(F)	(Ton)	(Ton)	(kW)	(Ton-Hr)		
1	64.3	60.7	0.0	625.0	563.1	3,232		
2	63.3	59.8	0.0	625.0	559.1	3,854		
3	62.4	59.2	0.0	625.0	556.6	4,476		
4	61.8	58.5	0.0	625.0	553.7	5,097		
5	61.6	58.3	0.0	625.0	552.8	5,718		
6	62.0	58.7	0.0	286.3	241.9	6,000		
7	63.1	59.8	0.0	0.0	0.0	6,000		
8	64.9	61.3	0.0	0.0	0.0	6,000		
9	67.5	62.3	207.6	207.6	150.6	6,000		
10	70.6	63.4	305.6	305.6	211.4	6,000		
11	74.0	65.1	491.7	491.7	327.3	6,000		
12	77.3	66.6	611.3	0.0	0.0	5,384		
13	79.7	68.1	579.7	0.0	0.0	4,800		
14	81.3	68.9	596.3	0.0	0.0	4,200		
15	81.9	69.3	623.8	0.0	0.0	3,573		
16	81.3	68.8	684.1	0.0	0.0	2,886		
17	79.9	68.2	694.6	0.0	0.0	2,189		
18	77.7	67.0	653.5	653.5	454.4	2,189		
19	75.0	66.9	506.2	506.2	342.9	2,189		
20	72.4	66.6	369.5	369.5	255.3	2,189		
21	70.2	65.3	283.2	283.2	204.4	2,189		
22	68.1	63.7	169.8	169.8	145.8	2,189		
23	66.5	62.5	112.6	112.6	119.2	2,189		
24	65.3	61.6	96.5	96.5	111.5	2,189		

				We	ekday		Saturday			
	Ty	pical	Cooling	Chiller	Chiller	Storage	Cooling	Chiller	Chiller	Storage
	DADB	DAMB	Load	Load	Demand	Capacity	Load	Load	Demand	Capacity
Hour	(F)	{F}	(Ton)	(Ton)	(kW)	(Ton-Hr)	(Ten)	(Ton)	{k#}	(Ton-Hr)
1	63.9	61.5	0.0	625.0	566.6	2,812	0.0	625.0	566.6	3,783
2	62.0	59.7	0.0	625.0	558.7	3,435	0.0	625.0	558.7	4,404
3	60.4	58.4	0.0	625.0	553.3	4,057	0.0	625.0	553.3	5,026
4	59.2	57.1	0.0	625.0	548.0	4,679	0.0	625.0	548.0	5,647
5	58.4	56.3	0.0	625.0	1544.9	5,300	0.0	357.6	294.5	6,000
6	58.2	56.1	0.0	625.0	544.2	5,921	0.0	0.0	0.0	6,000
7	58.7	56.7	0.0	84.0	116.4	6,000	0.0	0.0	0.0	6,000
8	60.1	57.9	0.0	0.0	0.0	6,000	0.0	0.0	0.0	5,000
9	62.4	58.6	79.2	79.2	100.6	6,000	79.2	79.2	100.6	6,000
10	65.2	59.5	142.2	142.2	127.6	6,000	142.9	142.9	127.9	6,000
11	68.3	61.1	275.3	275.3	190.4	6,000	275.3	275.3	190.4	6,000
12	71.5	62.7	415.0	0.0	0.0	5,580	415.0	0.0	0.0	5,580
13	74.3	64.6	413.9	0.0	0.0	5,167	414.3	0.0	0.0	5,161

Trane Air Conditioning Economics By: C.D.S. MARKETING

Typical Cooling Chiller Chiller Storage Cooling Chiller Chiller  BADB BANB Load Load Demand Capacity Load Load Demand Bour (F) (F) (Ton) (Ton) (kW) (Ton-Hr) (Ton) (Ton) (kW)  14 76.6 66.0 456.6 0.0 0.0 4,701 456.6 0.0 0.0 15 78.0 67.1 465.5 0.0 0.0 4,232 465.5 0.0 0.0 16 78.5 67.5 514.5 0.0 0.0 3,714 514.5 0.0 0.0 17 78.2 67.9 550.9 0.0 0.0 3,160 550.9 0.0 0.0 18 77.5 68.0 499.0 499.0 341.4 3,160 499.0 499.0 341.4 19 76.3 69.3 379.7 379.7 269.3 3,160 379.7 379.7 269.3	Storage Capacity (Ton-Hr) 4,701 4,231 3,714 3,160 3,160 3,160 3,160 3,160
Hour (F) (F) (Ton) (Ton) (kW) (Ton-Hr) (Ton) (Ton) (kW)  14 76.6 66.0 456.6 0.0 0.0 4,701 456.6 0.0 0.0  15 78.0 67.1 465.5 0.0 0.0 4,232 465.5 0.0 0.0  16 78.5 67.5 514.5 0.0 0.0 3,714 514.5 0.0 0.0  17 78.2 67.9 550.9 0.0 0.0 3,160 550.9 0.0 0.0  18 77.5 68.0 499.0 499.0 341.4 3,160 499.0 499.0 341.4	4,701 4,231 3,714 3,160 3,160 3,160 3,160 3,160
Hour (F) (F) (Ton) (Ton) (kW) (Ton-Hr) (Ton) (Ton) (kW)  14 76.6 66.0 456.6 0.0 0.0 4,701 456.6 0.0 0.0  15 78.0 67.1 465.5 0.0 0.0 4,232 465.5 0.0 0.0  16 78.5 67.5 514.5 0.0 0.0 3,714 514.5 0.0 0.0  17 78.2 67.9 550.9 0.0 0.0 3,160 550.9 0.0 0.0  18 77.5 68.0 499.0 499.0 341.4 3,160 499.0 499.0 341.4	4,701 4,231 3,714 3,160 3,160 3,160 3,160 3,160
14     76.6     66.0     456.6     0.0     0.0     4,701     456.6     0.0     0.0       15     78.0     67.1     465.5     0.0     0.0     4,232     465.5     0.0     0.0       16     78.5     67.5     514.5     0.0     0.0     3,714     514.5     0.0     0.0       17     78.2     67.9     550.9     0.0     0.0     3,160     550.9     0.0     0.0       18     77.5     68.0     499.0     499.0     341.4     3,160     499.0     499.0     341.4	4,231 3,714 3,160 3,160 3,160 3,160 3,160
15 78.0 67.1 465.5 0.0 0.0 4,232 465.5 0.0 0.0 16 78.5 67.5 514.5 0.0 0.0 3,714 514.5 0.0 0.0 17 78.2 67.9 550.9 0.0 0.0 3,160 550.9 0.0 0.0 18 77.5 68.0 499.0 499.0 341.4 3,160 499.0 499.0 341.4	4,231 3,714 3,160 3,160 3,160 3,160 3,160
16 78.5 67.5 514.5 0.0 0.0 3,714 514.5 0.0 0.0 17 78.2 67.9 550.9 0.0 0.0 3,160 550.9 0.0 0.0 18 77.5 68.0 499.0 499.0 341.4 3,160 499.0 499.0 341.4	3,714 3,160 3,160 3,160 3,160 3,160
16 78.5 67.5 514.5 0.0 0.0 3,714 514.5 0.0 0.0 17 78.2 67.9 550.9 0.0 0.0 3,160 550.9 0.0 0.0 18 77.5 68.0 499.0 499.0 341.4 3,160 499.0 499.0 341.4	3,160 3,160 3,160 3,160 3,160
18 77.5 68.0 499.0 499.0 341.4 3,160 499.0 499.0 341.4	3,160 3,160 3,160 3,160
	3,160 3,160 3,160
19 76.3 69.3 379.7 379.7 269.3 3 160 379.7 379.7 269.3	3,160 3,160
	3,160
20 74.7 70.0 348.0 348.0 252.5 3,160 348.0 348.0 252.5	
21 72.7 69.0 290.0 290.0 216.9 3,160 290.0 290.0 216.9	
22 70.6 67.3 190.0 190.0 161.7 3,160 190.0 190.0 161.7	3,160
23 A9 3 A5 4 121 A 121 A 127 O 3 1AO 121 A 121 A 127 O	3,160
23 68.3 65.4 121.4 121.4 127.0 3,160 121.4 121.4 127.0 24 66.1 63.6 104.2 104.2 117.3 3,160 104.2 104.2 117.3	3,160
Typical Cooling Chiller Chiller Storage Cooling Chiller Chiller	
Typical Cooling Chiller Chiller Storage Cooling Chiller Chiller  OADB OAMB Load Load Demand Capacity Load Load Demand	Storage Capacity
	(Ton-Hr)
Hour (F) (F) (Ton) (Ton) (kW) (Ton-Hr) (Ton) (KW)	(100 111)
1 63.9 61.5 0.0 625.0 566.6 3,782 0.0 625.0 566.6	3,782
2 62.0 59.7 0.0 625.0 558.7 4,404 0.0 625.0 558.7	
3 60.4 58.4 0.0 625.0 553.3 5,026 0.0 625.0 553.3	5,026
4 59.2 57.1 0.0 625.0 548.0 5,647 0.0 625.0 548.0	5,647
5 58.4 56.3 0.0 357.9 294.7 6,000 0.0 357.9 294.7	6,000
1 50 5 5/ 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	6,000
6 58.2 56.1 0.0 0.0 0.0 6,000 0.0 0.0 0.0 7 58.7 56.7 0.0 0.0 0.0 6,000 0.0 0.0 0.0	6,000
8 60.1 57.9 0.0 0.0 0.0 6,000 0.0 0.0 0.0	6,000
9 62.4 58.6 79.2 79.2 100.6 6.000 79.2 79.2 100.6	6,000
10 65.2 59.6 142.9 142.9 127.9 6,000 142.9 142.9 127.9	6,000
- 11 68.3 61.1 275.3 275.3 190.4 6,000 275.3 275.3 190.4	6,000
- 11 68.3 61.1 275.3 275.3 190.4 6,000 275.3 275.3 190.4 12 71.5 62.7 415.0 0.0 0.0 5,580 415.0 0.0 0.0	5,580
13 74.3 64.6 414.3 0.0 0.0 5,161 414.3 0.0 0.0	5,161
14 76.6 66.0 456.6 0.0 0.0 4.701 456.6 0.0 0.0	4,701
15 78.0 67.1 465.5 0.0 0.0 4,231 465.5 0.0 0.0	4,231
16 78.5 67.5 514.5 0.0 0.0 3,714 514.5 0.0 0.0	3,714
17 78.2 67.9 550.9 0.0 0.0 3,160 550.9 0.0 0.0	3,160
18 77.5 68.0 499.0 499.0 341.4 3,160 499.0 499.0 341.4	3,160
19 76.3 69.3 379.7 379.7 269.3 3,160 379.7 379.7 269.3	3,160
20 74.7 70.0 348.0 348.0 252.5 3,160 348.0 348.0 252.5	3,160
21 72.7 59.0 290.0 290.0 216.9 3,160 290.0 290.0 216.9	3,160
22 70.6 67.3 190.0 190.0 161.7 3,160 190.0 190.0 161.7	3,160
23 68.3 65.4 121.4 121.4 127.0 3,160 121.4 121.4 127.0	
24 66.1 63.6 104.2 104.2 117.3 3,160 104.2 104.2 117.3	3,160

# ECO IT-4

---- BUILDING COOLING DEMANDS AND THERMAL STORAGE----

June

				D	esign	
	Desi	ign	Cooling	Chiller	Chiller	Storage
	DADB	DAWB	Load	Load	Demand	Capacity
Hour	(F)	(F)	{Ton}	(Ton)	(kW)	(Ton-Hr)
1	68.7	65.1	0.0	0.0	0.0	6,000
2	67.8	64.4	0.0	0.0	0.0	6,000
3	67.0	63.5	0.0	0.0	0.0	6,000
4	66.4	62.7	0.0	0.0	0.0	6,000
5	66.3	62.7	0.0	0.0	0.0	6,000
6	65.6	63.7	0.0	0.0	0.0	6,000
7	67.6	64.5	0.0	0.0	0.0	6,000
8	69.3	65.1	0.0	0.0	0.0	6,000
9	71.8	66.0	0.0	0.0	0.0	6,000
10	74.6	67.6	109.2	109.2	101.4	6,000
11	77.8	69.8	241.8	241.8	168.0	6,000
12	80.9	71.9	384.5	0.0	0.0	5,611
13	83.2	73.5	353.7	0.0	0.0	5,252
14	84.7	74.4	435.0	0.0	0.0	4,813
15	85.3	74.6	542.1	0.0	0.0	4,267
16	84.7	74.5	682.4	0.0	0.0	3,582
17	83.4	73.5	8.608	0.0	0.0	2,772
18	81.3	71.5	768.0	635.0	449.1	2,639
19	78.8	70.1	652.3	635.0	444.0	2,627
20	76.3	70.0	591.1	591.1	405.7	2,627
21	74.2	69.5	546.4	546.4	367.2	2,622
22	72.3	68.7	422.4	422.4	272.8	2,622
23	70.8	67.1	0.0	490.0	455.8	3,110
. 24	69.7	65.8	0.0	490.0	460.7	3,597

				He	ekday		Saturday				
	Typ	pical	Cooling	Chiller	Chiller	Storage	Cooling	Chiller	Chiller	Storage	
	DADE	DAMB	Load	Load	Demand	Capacity	Load	Load	Demend	Capacity	
Hour	(F)	(F)	(Ton)	(Ton)	(kW)	(Ton-Hr)	(Ton)	(Ton)	(比解)	(Ton-Hr)	
1	67.6	65.3	0.0	490.0	458.8	4,084	0.0	490.0	458.8	3,934	
2	66.0	63.9	0.0	490.0	453.5	4,571	0.0	490.0	453.5	4,421	
3	64.6	62.4	0.0	490.0	448.0	5,057	0.0	490.0	448.0	4,907	
4	63.7	61.3	0.0	490.0	444,1	5,543	0.0	490.0	444.1	5,393	
5	63.0	60.8	0.0	461.3	409.6	6,000	0.0	490.0	442.4	5,879	
6	62.8	61.2	0.0	0.0	0.0	6,000	0.0	125.7	127.0	6,000	
7	63.4	61.7	0.0	0.0	0.0	5,000	0.0	0.0	0.0	6,000	
8	65.1	62.3	0.0	0.0	0.0	6,000	0.0	0.0	0.0	6,000	
9	67.6	63.3	0.0	0.0	0.0	6,000	0.0	0.0	0.0	6,000	
10	70.7	65.2	286.9	285.9	182.6	6,000	286.9	286.9	182.5	6,000	
11	74.0	67.5	432.3	432.3	276.5	6,000	432.3	432.3	276.5	6,000	
12	77.1	69.8	557.6	0.0	0.0	5,438	557.6	0.0	0.0	5,438	
13	79.6	71.6	535.2	0.0	0.0	4,898	535.2	0.0	0.0	4,898	

Trane Air Conditioning Economics By: C.D.S. MARKETINS

COLD THERMAL STORAGE - ALTERNATIVE 4 11 HOUR ICE BUILD, 7 HOUR CHILLER RUN

				¥e	ekdav		Saturday			
	Tv	pical	Cooline	Chiller	Chiller	Storage				
	DADB	DAWE	Load	Load		Capacity		Load		
Hour		(F)				(Ton-Hr)		(Ton)		
			(,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	(,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,		,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	• • • • •			
14	81.3	72.7	534.2	0.0	0.0	4,360	534.2	0.0	0.0	4,360
15	81.8	72.8	561.4	0.0	0.0	3,795	561.4	0.0	0.0	3,795
16	81.6	73.1	609.6	0.0	0.0	3,182	609.6	0.0	0.0	3,182
17	81.0	72.7	678.8	0.0	0.0	2,501	678.8	0.0	0.0	2,501
18	80.0	71.6	665.1	635.0	449.5	2,471	665.1	635.0	449.5	2,471
19	78.7	71.3	542.0	542.0	369.4	2,471	542.0		369.4	2,471
20	77.1	72.0	496.4	496.4	335.5	2,471	495.4	496.4		2,471
21	75.3	71.8	448.1	448.1	298.9	2,471		448.1		2,471
22	73.3	71.0	338.5	338.5		2,471				2,471
23	71.3	68.9	0.0	490.0		2,959				2,959
24	69.4	66.8	0.0	490.0	464.6	3,447		490.0		3,447
• •			• • • • • • • • • • • • • • • • • • • •	.,,,,,		-,				,
				S	unday		<u>}</u>	londay		
	Ty	pical	Cooling	Chiller	Chiller	Storage	Cooling	Chiller	Chiller	Storage
	DADE	DAME	Load	Load	Demand	Capacity	Load	Load	Demand	Capacity
Hour	(F)	(F)	(Ton)			(Ton-Hr)		(Ton)	(k#)	(Ton-Hr)
1	67.6	65.3	0.0	490.0	458.8	3,934	0.0	490.0	458.8	
2	65.0	63.9	0.0	490.0	453.5	4,421	0.0	490.0	453.5	4,421
3	64.6	62.4	0.0	490.0	448.0	4,907	0.0	490.0	448.0	<b>4,9</b> 07
4	63.7	61.3	0.0	490.0	444.1	5,393	0.0	490.0	444.1	5,393
5	63.0	60.8	0.0	490.0	442.4	5,879	0.0	490.0	442.4	5,879
6	62.8	61.2	0.0	125.7	127.0	6,000	0.0	125.7	127.0	€,000
7	63.4	61.7	0.0	0.0	0.0	6,000	0.0	0.0	0.0	6,000
8	65.1	62.3	0.0	0.0	0.0	6,000	0.0	0.0	0.0	6,000
9	67.6	63.3	0.0	0.0	0.0	6,000	0.0	0.0	0.0	6,000
10	70.7	65.2	286.9	286.9	182.6	6,000	286.9			
11	74.0	67.5	432.3	432.3	276.5	5,000	432.3	432.3		6,000
12	77.1	69.8	557.6	0.0	0.0	5,438	557.6			5,438
13	79.6	71.6	535.2	0.0	0.0	4,898	535.2	0.0		•
14	81.3	72.7	534.2	0.0	0.0	4,360				
15	81.8	72.8	561.4	0.0	0.0	3,795				
16	81.6	73.1	609.6	0.0	0.0	3,182				3,182
17	81.0	72.7	678.8	0.0	0.0	2,501	678.8			2,501
18	80.0	71.6	665.1	635.0	449.5	2,471	665.1	635.0	449.5	
19	78.7	71.3	542.0	542.0	369.4	2,471	542.0	542.0		2,471
20	77.1	72.0	496.4	496.4	335.5	2,471	496.4	496.4		2,471
21	75.3	71.8	448.1	448.1	298.9	2,471	448.1	449.1	298.9	2,471
22	73.3	71.0	338.5	338.5	225.0	2,471	338.5	338.5	225.0	2,471
23	71.3	68.9	0.0			2,959	0.0	490.0	473.0	2,959
24	69.4	66.8	0.0		464.6	3,447	0.0	490.0	464.6	3,447

---- BUILDING COOLING DEMANDS AND THERMAL STORAGE----

July

		Design						
	Des.	ign	Cooling	Chiller	Chiller	Storage		
	DADB	DAMB	Load	Load	Demand	Capacity		
Hour	(F)	(F)	(Ton)	(Ton)	(kW)	(Ton-Hr)		
1	73.4	8.8	0.0	490.0	472.6	3,934		
2	72.3	67.9	0.0	490.0	468.9	4,421		
3	71.4	67.2	0.0	490.0	466.2	4,907		
4	70.7	67.0	0.0	490.0	465.4	5,393		
5	70.5	66.9	0.0	490.0	465.0	5,879		
6	71.0	67.4	0.0	125.7	136.7	6,000		
7	72.1	68.4	0.0	0.0	0.0	6,000		
8	- 74.1	69.3	0.0	0.0	0.0	6,000		
9	77.0	70.1	0.0	0.0	0.0	6,000		
10	80.4	71.4	494.4	494.4	332.2	5,000		
11	84.2	73.3	672.3	635.0	455.9	5,963		
12	87.8	75.5	775.6	0.0	0.0	5,182		
13	90.5	76.5	733.0	0.0	0.0	4,445		
14	92.3	75.8	763.3	0.0	0.0	3,678		
15	93.0	77.0	805.4	0.0	0.0	2,870		
16	92.3	76.7	891.8	0.0	0.0	1,976		
17	90.8	75.3	889.6	0.0	0.0	1,085		
18	88.3	74.2	860.2	635.0	459.3	860		
19	85.4	72.9	714.1	635.0	454.3	780		
20	82.4	73.4	680.5	635.0	456.2	735		
21	80.0	73.0	641.2	635.0	454.7	729		
22	77.7	72.3	559.5	559.5	387.0	729		
23	75.9	70.6	0.0	490.0	479.9	1,218		
24	74.6	69.4	0.0	490.0	475.0	1,707		

				¥e	ekday	Saturday				
	Ty	pical	Cooling	Chiller	Chiller	Storage	Cooling	Chiller	Chiller	Storage
	DADR	DAMB	Load	Load	Demand	Capacity	Load	Load	Demand	Capacity
Hour	(F)	(F)	(Ton)	(Ton)	(k₩)	(Ton-Hr)	(Ton)	(Ton)	(kW)	(Ton-Hr)
1	74.3	71.0	0.0	490.0	481.6	2,196	0.0	490.0	481.6	3,194
2	71.9	8.83	0.0	490.0	472.6	2,684	0.0	490.0	472.6	3,681
3	69.9	67.0	0.0	490.0	465.4	3,172	0.0	490.0	465.4	4,168
4	68.3	65.9	0.0	490.0	461.1	3,659	0.0	490.0	461.1	4,655
5	67.4	65.2	0.0	490.0	458.4	4,147	0.0	490.0	458.4	5,141
é	67.0	64.9	0.0	490.0	457.3	4,633	0.0	490.0	457.3	5,627
7	67.5	65.3	0.0	490.0	458.8	5,120	0.0	377.3	335.3	6,000
8	8.83	65.6	0.0	490.0	459.9	5,605	0.0	0.0	0.0	6,000
9	70.9	65.7	0.0	399.0	358.7	6,000	0.0	0.0	0.0	6,000
10	73.6	66.5	305.3	305.3	195.4	6,000	305.3	305.3	195.4	6,000
11	76.7	67.9	454.0	454.0	292.7	6,000	454.0	454.0	292.7	5,000
12	79.9	69.9	581.5	0.0	0.0	5,414	581.5	0.0	0.0	5,414
13	83.0	71.3	563.2	0.0	0.0	4,846	563.2	0.0	0.0	4,846

Trane Air Conditioning Economics By: C.D.S. MARKETING

	Weekday						Saturday			
	Tvi	pical	Conline	Chiller	Chiller	Storage				
	DADB	DAWB	Load	Load				Load		Capacity
Hour	(F)	(F)	(Ton)	(Ton)		(Ton-Hr)		(Ton)		
וטטוו	1, 1	() ;	(1011)	(1011)	( 677 )	(1011 111 )	(1011)	(70/7)	(6.07)	(1011 111)
14	85.7	72.5	597.7	0.0	0.0	4,245	597.7	0.0	0.0	4,245
15	87.8	73.9	654.3	0.0	0.0	3,587	654.3	0.0	0.0	3,587
16	89.1	75.3	737.3	0.0	0.0	2,847	737.3	0.0	0.0	2,847
17	89.5	75.5	810.6	0.0	0.0	2,034	810.6	0.0	0.0	2,034
18	89.2	76.2	803.8	635.0	467.1	1,865	803.8	635.0	467.1	1,865
19	88.3	76.7	700.3	635.0	469.1	1,800	700.3	635.0	469.1	1,800
20	86.7	78.6	684.0	635.0	476.7	1,751	684.0	635.0	476.7	1,751
21	84.7	78.8	656.5	635.0	477.5	1,729	656.5	635.0	477.5	1,729
22	82.3	78.0	549.7	549.7	397.9	1,729	549.7	549.7	397.9	1,729
23	79.6	75.4	0.0	490.0	500.4	2,218	0.0	490.0	500.4	2,218
24	76.9	73.0	0.0	490.0	490.0	2,706	0.0	490.0	490.0	2,706
				S	unday					
	Ty	pical	Cooling	Chiller	Chiller	Storage	Cooling			Storage
	DADE	BAWB	Load	Load		Capacity	Load		Demand	
Hour	(F)	(F)	(Ton)	(Ton)	{kH}	(Ton-Hr)	(Ton)	(Ton)	(k₩)	(Ton-Hr)
1	74.3	71.0	0.0	490.0	481.6	3,194	0.0	490.0	481.6	3,194
2	71.9	8.8	0.0	490.0	472.6	3,681	0.0	490.0		3,681
3	69.9	67.0	0.0	490.0	465.4	4,168	0.0	490.0		4,168
4	68.3	65.9	0.0	490.0	461.1	4,655	0.0	490.0		4,655
5	67.4	65.2	0.0	490.0	458.4	5,141	0.0	490.0		5,141
6	67.0	64.9	0.0	490.0	457.3	5,627	0.0	490.0		5,627
7	67.5	65.3	0.0	377.3	335.3	6,000	0.0	377.3		6,000
8	68.8	65.6	0.0	0.0	0.0	6,000	0.0	0.0		6,000
9	70.9	65.7	0.0	0.0	0.0	6,000	0.0			6,000
10	73.6	66.5	305.3	305.3	195.4	6,000	305.3	305.3		6,000
- 11	76.7	67.9	454.0	454.0	292.7	6,000	454.0			6,000
12	79.9	69.9	581.5	0.0	0.0	5,414	581.5			5,414
13	B3.0	71.3	563.2	0.0	0.0	4,846	563.2			4,846
14	85.7	72.5	597.7		0.0	4,245	597.7			4,245
15	87.8	73.9	654.3		0.0	3,587				
16	89.1	75.3			0.0	2,847	737.3			•
17	89.5	75.5	810.6	0.0	0.0	2,034				2,034
18	89.2	76.2	803.8	635.0	467.1	1,865		635.0	467.1	1,865
19	88.3	76.7	700.3	635.0	459.1	1,800	700.3	635.0		1,800
20	86.7	78.5	684.0	635.0	476.7	1,751	684.0	635.0		1,751
21	84.7	78.8	656.5	635.0	477.5	1,729	656.5			1,729
22	82.3	78.0		549.7	397.9	1,729	549.7			1,729
23	79.6	75.4	0.0	490.0	500.4	2,218	0.0			2,218
24	76.9	73.0		490.0	490.0	2,706	0.0			2,706

#### ---- BUILDING COOLING DEMANDS AND THERMAL STORAGE----

August

		Design								
		Desi	ign	Cooling	Chiller	Chiller	Storage			
		DADR	DAME	Load	Load	Demand	Capacity			
H	our	(F)	(F)	(Ton)	(Ton)	(kW)	(Ton-Hr)			
	i	70.5	64.5	0.0	490.0	455.7	3,194			
	2	69.5	63.5	0.0	490.0	452.0	3,681			
	3	68.7	63.0	0.0	490.0	450.2	4,168			
	4	68.1	62.4	0.0	490.0	448.0	4,655			
	5	67.9	62.6	0.0	490.0	448.7	5,141			
	6	68.3	63.2	0.0	490.0	450.9	5,627			
	7	69.3	64.1	0.0	377.3	331.6	6,000			
	8	71.1	64.9	0.0	0.0	0.0	6,000			
	9	73.7	66.1	0.0	0.0	0.0	6,000			
	10	75.8	67.2	406.9	406.9	258.7	6,000			
	11	80.2	68.9	583.6	583.6	395.7	6,000			
	12	83.4	70.6	695.3	0.0	0.0	5,300			
	13	85.8	71.5	664.3	0.0	0.0	4,631			
	14	87.5	72.5	698.6	0.0	0.0	3,929			
	15	88.1	72.7	727.3	0.0	0.0	3,199			
	16	87.5	71.7	794.2	0.0	0.0	2,402			
	17	86.0	70.6	806.4	0.0	0.0	1,593			
	18	83.8	69.7	758.7	635.0	442.5	1,470			
	19	81.2	68.5	598.2	598.2	406.7	1,470			
	20	78.6	68.7	545.2	545.2	363.8	1,470			
٠.	21	76.4	68.8	454.4	454.4	295.4	1,470			
	22	74.3	67.6	321.1	321.1	205.7	1,470			
	23	72.7	66.4	0.0	490.0	463.0	1,959			
	24	71.5	65.3	0.0	490.0	458.8	2,447			

				#e	ekday			Sa	Saturday			
	Ty	pical	Cooling	Chiller	Chiller	Storage	Cooling	Chiller	Chiller	Storage		
	DADE	DANE	Load	Load	Demand	Capacity	Load	Load	Demand	Capacity		
Hour	(F)	(F)	(Ton)	(Ton)	(kW)	(Ton-Hr)	(Ton)	(Ton)	(k¥)	(Ton-Hr)		
1	70.1	65.3	0.0	490.0	458.8	2,935	0.0	490.0	458.8	4,056		
2	68.2	63.5	0.0	490.0	452.0	3,423	0.0	490.0	452.0	4,553		
3	66.6	62.2	0.0	490.0	447.3	3,910	0.0	490.0	447.3	5,039		
4	65.4	61.1	0.0	490.0	443.4	4,397	0.0	490.0	443.4	5,525		
5	64.6	60.7	0.0	490.0	442.0	4,883	0.0	479.3	429.7	6,000		
6	64.4	60.7	0.0	490.0	442.0	5,369	0.0	0.0	0.0	6,000		
7	64.9	61.2	0.0	490.0	443.8	5,855	0.0	0.0	0.0	6,000		
8	66.3	61.6	0.0	149.6	142.6	6,000	0.0	0.0	0.0	6,000		
9	68.5	62.5	0.0	0.0	0.0	6,000	0.0	0.0	0.0	6,000		
10	71.4	63.6	250.5	250.5	160.7	6,000	250.6	250.6	160.7	6,000		
11	74.5	65.1	396.0	395.0	246.6	6,000	396.0	396.0	246.6	6,000		
12	77.6	66.8	504.8	0.0	0.0	5,490	504.8	0.0	0.0	5,490		
13	80.5	68.2	495.1	0.0	0.0	4,991	495.1	0.0	0.0	4,991		

Trane Air Conditioning Economics By: C.D.S. MARKETING

			Weekday				Saturday			
	Ty	pical	Cooline	Chiller	Chiller	Storage			Chiller	
	DADB	DAMB	Load	Load				Load	Desand	Capacity
Hour	(F)	(F)	(Ton)	(Ton)		(Ton-Hr)	(Ton)		(kW)	(Ton-Hr)
	V-1		(,,,,,	(,	(***)	(101. 11. )	(12)	(	()	(,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,
14	82.7	69.7	525.9	0.0	0.0	4,461	525.9	0.0	0.0	4,461
15	84.2	70.7	562.3	0.0	0.0	3,895	562.3	0.0	0.0	3,895
16	84.6	70.5	612.6	0.0	0.0	3,279	612.6	0.0	0.0	3,279
17	84.4	70.4	668.2	0.0	0.0	2,609	668.2	0.0	0.0	2,609
18	83.6	70.7	640.3	635.0	446.2	2,603	640.3	635.0	446.2	2,603
19	82.4	70.7	496.1	496.1	331.5	2,603	496.1	496.1	331.5	2,603
20	80.8	71.9	476.3	476.3	319.9	2,603	475.3	476.3	319.9	2,603
21	78.9	72.4	433.7	433.7	290.2	2,603	433.7	433.7	290.2	2,603
22	76.8	71.1	330.5	330.5	220.5	2,603	330.5	330.5	220.5	2,603
23	74.5	69.3	0.0	490.0	474.6	3,091	0.0	490.0	474.6	3,091
24	72.2	67.2	0.0	490.0	466.2	3,579	0.0	490.0	466.2	3,579
-						·				
	•		Sundayical Cooling Chiller Chiller Storage							
	•	pical				•	-		Chiller	_
	DADB	DANB	Load	Load				Load		
Hour	(F)	(F)	(Ton)	(Ton)	(kW)	(Ton-Hr)	(not)	(Ton)	(kW)	(Ton-Hr)
1	70.1	65.3	0.0	490.0	458.8	4,065	0.0	490.0	455.8	4,065
2	68.2	63.5	0.0	490.0	452.0	4,553	0.0	490.0		•
3	66.6	62.2	0.0	490.0	447.3	5,039	0.0	490.0		5,039
4	65.4	61.1	0.0	490.0		5,525	0.0	490.0		5,525
5	64.6	60.7	0.0		443.4 429.7	•	0.0	479.4	429.7	
5	64.4	60.7		479.4		6,000			0.0	6,000
7		61.2	0.0	0.0	0.0	6,000	0.0	0.0		6,000
	64.9		0.0	0.0	0.0	6,000	0.0	0.0	0.0	6,000
8 9	66.3	61.6	0.0	0.0	0.0	6,000	0.0	0.0	0.0	6,000
	68.5	62.5	0.0	0.0	0.0	6,000	0.0	0.0	0.0	6,000
10	71.4	63.6	250.6	250.6	160.7	6,000	250.6	250.6	160.7	6,000
11	74.5	65.1 66.8	396.0	396.0	246.6	6,000	396.0	396.0	246.6 0.0	6,000
12	77.6	68.2	504.8	0.0	0.0	5,490	504.8	0.0	0.0	5,490
	80.5		495.1	0.0	0.0	4,991	495.1	0.0		4,991
14	82.7	69.7	525.9	0.0	0.0	4,461	525.9		0.0	4,461
15	84.2	70.7	562.3	0.0	0.0	3,895	562.3	0.0	0.0	3,895
16	84.6	70.5	612.6	0.0	0.0	3,279	612.6	0.0	0.0	3,279
17	84.4	70.4	668.2	0.0	0.0	2,609	668.2	0.0	0.0	2,609
18	83.6	70.7	640.3	635.0	446.2	2,603	640.3	635.0	446.2	2,603
19	82.4	70.7	496.1	496.1	331.5	2,603		496.1	331.5	2,603
20	80.8	71.9	476.3	476.3	319.9	2,603	476.3	476.3	319.9	2,603
21	78.9	72.4	433.7	433.7	290.2	2,603	433.7	433.7	290.2	2,603
22	76.8	71.1	330.5	330.5	220.5	2,603	330.5	330.5	220.5	2,603
23	74.5	69.3	0.0	490.0	474.6	3,091	0.0	490.0	474.6	3,091
24	72.2	67.2	0.0	490.0	466.2	3,579	0.0	490.0	466.2	3,579

---- BUILDING CODLING DEMANDS AND THERMAL STORAGE----

September

			Design							
	Desi	.gn	Cooling	Chiller	Chiller	Storage				
	DADB	DAWE	Load	Load	Demand	Capacity				
Hour	(F)	(F)	(Ton)	(Ton)	(kW)	(Ton-Hr)				
1	64.3	60.7	0.0	490.0	442.0	4,066				
2	63.3	59.8	0.0	490.0	439.0	4,553				
3	62.4	59.2	0.0	490.0	437.0	5,039				
4	61.8	58.5	0.0	490.0	434.7	5,525				
5	61.6	58.3	0.0	479.4	421.9	6,000				
6	62.0	58.7	0.0	0.0	0.0	6,000				
7	63.1	59.8	0.0	0.0	0.0	6,000				
8	64.9	61.3	0.0	0.0	0.0	6,000				
9	67.5	62.3	0.0	0.0	0.0	6,000				
10	70.6	63.4	305.6	305.6	189.1	6,000				
11	74.0	65.1	491.7	491.7	312.5	6,000				
12	77.3	66.6	611.3	0.0	0.0	5,384				
13	79.7	68.1	579.7	0.0	0.0	4,800				
14	81.3	68.9	596.3	0.0	0.0	4,200				
15	81.9	69.3	623.8	0.0	0.0	3,573				
16	81.3	8.83	684.1	0.0	0.0	2,886				
17	79.9	68.2	694.6	0.0	0.0	2,189				
18	77.7	67.0	653.5	635.0	433.1	2,170				
19	75.0	66.9	506.2	506.2	328.2	2,170				
20	72.4	56.6	369.5	369.5	233.3	2,170				
21	70.2	65.3	283.2	283.2	180.9	2,170				
22	68.1	63.7	169.8	169.8	122.8	2,170				
- 23	66.5	62.5	0.0	490.0	448.4	2,658				
24	65.3	61.6	0.0	490.0	445.2	3,146				

				Ne	ekday		Saturday			
	Ty	pical	Cooling	Chiller	Chiller	Storage	Cooling	Chiller	Chiller	Storage
	DADE	DAWE	Load	Load	Demand	Capacity	Losd	Load	Demand	Capacity
Hour	(F)	(F)	(Ton)	(Ton)	(kW)	(Ton-Hr)	(Ten)	(Ton)	(k#)	(Ton-Hr)
1	63.9	61.5	0.0	490.0	444.8	3,634	0.0	490.0	444.8	4,621
2	62.0	59.7	0.0	490.0	438.6	4,121	0.0	490.0	438.6	5,108
3	60.4	58.4	0.0	490.0	434.4	4,608	0.0	490.0	434.4	5,594
4	59.2	57.1	0.0	490.0	430.3	5,094	0.0	411.0	344.7	6,000
5	58.4	56.3	0.0	490.0	427.9	5,580	0.0	0.0	0.0	6,000
ė	58.2	56.1	0.0	424.6	356.0	6,000	0.0	0.0	0.0	6,000
7	58.7	56.7	0.0	0.0	0.0	6,000	0.0	0.0	0.0	6,000
8	60.1	57.9	0.0	0.0	0.0	6,000	0.0	0.0	0.0	6,000
9	62.4	58.6	0.0	0.0	0.0	6,000	0.0	0.0	0.0	6,000
10	65.2	59.6	142.2	142.2	105.9	6,000	142.9	142.9	106.1	6,000
11	48.3	61.1	275.3	275.3	168.6	6,000	275.3	275.3	168.6	6,000
12	71.5	62.7	415.0	0.0	0.0	5,580	415.0	0.0	0.0	5,580
13	74.3	64.6	413.9	0.0	0.0	5,162	414.3	0.0	0.0	5,161

Trane Air Conditioning Economics By: C.D.S. MARKETING

				Ne	ekdav		Saturday				
	Ty	pical	Cooling	Chiller	Chiller	Storage					
	DADE	DAMB	Load	Load	Desand	Capacity	Load			Capacity	
Hour	(F)	(F)		(Ton)	(k#)	(Ton-Hr)	(Ton)	(Ton)	(kW)	(Ton-Hr)	
14	76.6	66.0	456.6	0.0	0.0	4,701	456.6	0.0	0.0	4,701	
15	78.0	67.1	465.5	0.0	0.0	4,232	465.5	0.0	0.0	4,231	
16	78.5	67.5	514.5	0.0	0.0	3,714	514.5	0.0	0.0	3,714	
17	78.2	67.9	550.9	0.0	0.0	3,160	550.9	0.0	0.0	3,160	
18	77.5	68.0	499.0	499.0	325.9	3,160	499.0	499.0	325.9	3,160	
19	76.3	69.3	379.7	379.7	245.9	3,160	379.7	379.7	245.9	3,160	
20	74.7	70.0	348.0	348.0	228.3	3,160	348.0	348.0	228.3	3,160	
21	72.7	69.0	290.0	290.0	192.4	3,160	290.0	290.0	192.4	3,160	
22	70.6	67.3	190.0	190.0	137.7	3,160	190.0	190.0	137.7	3,160	
23	68.3	65.4	0.0	490.0	459.2	3,648	0.0	490.0		3,647	
24	66.1	63.6	0.0	490.0	452.4	4,135	0.0	490.0	452.4	4,134	
	Ty	pical	Cooling		Chiller	Storage				Storage	
	DADB	DAMB	Load	Load		Capacity					
Hour	(F)	(F)	(Ton)	(Ton)	(k∰)	(Ton-Hr)	(Ton)	(Ton)	(k₩)	(Ton-Hr)	
1	63.9	61.5	0.0	490.0	444.9	4,621		490.0			
2	62.0	59.7	0.0	490.0	438.6	5,107	0.0	490.0		5,107	
3	60.4	58.4	0.0	490.0	434.4	5,593	0.0	490.0		5,593	
4	59.2	57.1	0.0	411.3	345.1	6,000	0.0			6,000	
5	58.4	56.3	0.0	0.0	0.0	6,000	0.0	0.0		6,000	
6	58.2	56.1	0.0	0.0	0.0	6,000	0.0			6,000	
7	58.7	56.7	0.0	0.0	0.0	6,000	0.0			6,000	
8	60.1	57.9	0.0	0.0	0.0	6,000	0.0	0.0		6,000	
9	62.4	58.6	0.0	0.0	0.0	6,000	0.0			6,000	
10	65.2	59.6	142.9			6,000	142.9			6,000	
11	68.3	61.1	275.3			6,000	275.3			6,000	
12	71.5	62.7	415.0			5,580	415.0			5,580	
13	74.3	64.6	414.3			5,161	414.3			5,161	
14	76.6	66.0	456.6			4,701	456.6			4,701	
15	78.0		465.5			4,231	465.5			4,231	
16	78.5					3,714	514.5			3,714	
17	78.2	67.9	550.9			3,160	550.9			3,160	
18		68.0		499.0			499.0			3,160	
19	76.3	69.3				3,160	379.7			3,160	
20	74.7	70.0				3,160	348.0			3,160	
21	72.7	69.0	290.0			3,160	290.0			3,160	
22	70.6	67.3				3,160	190.0			3,160	
23	68.3	65.4	0.0			3,647	0.0			3,647	
24	66.1	63.6	0.0	490.0	452.4	4,134	0.0	490.0	452.4	4,134	

# ECO IT-5

#### ---- BUILDING COOLING DEMANDS AND THERMAL STORAGE----

June

			Design						
	Desi	ign	Cooling	Chiller	Chiller	Storage			
	DADE	DANE	Load	Load	Demand	Capacity			
Hour	{F}	(F)	(Ton)	(Ton)	(kW)	(Ton-Hr)			
1	68.7	65.1	0.0	0.0	0.0	4,500			
2	67.8	64.4	0.0	0.0	0.0	4,500			
3	67.0	63.5	0.0	0.0	0.0	4,500			
4	66.4	62.7	0.0	0.0	0.0	4,500			
5	66.3	62.7	0.0	0.0	0.0	4,500			
6	66.6	63.7	0.0	0.0	0.0	4,500			
7	67.6	64.5	0.0	0.0	0.0	4,500			
8	69.3	65.1	0.0	0.0	0.0	4,500			
9	71.8	66.0	0.0	0.0	0.0	4,500			
10	74.6	67.6	109.2	109.2	98.1	4,500			
11	77.8	69.8	241.8	241.8	172.7	4,500			
12	80.9	71.9	384.5	384.5	275.8	4,500			
13	83.2	73.5	353.7	0.0	0.0	4,143			
14	84.7	74.4	435.0	0.0	0.0	3,704			
15	85.3	74.6	542.1	0.0	0.0	3,159			
16	84.7	74.5	682.4	520.0	403.3	2,997			
17	83.4	73.5	8.408	520.0	399.9	2,710			
18	81.3	71.5	768.0	520.0	393.3	2,462			
19	78.8	70.1	652.3	520.0	388.9	2,330			
20	76.3	70.0	591.1	520.0	388.5	2,259			
21	74.2	69.5	546.4	520.0	387.0	2,232			
22	72.3	68.7	422.4	422.4	298.4	2,232			
- 23	70.8	67.1	0.0	400.0	379.7	2,631			
24	69.7	65.8	0.0	400.0	375.6	3,028			

	Weekday						Saturday				
	Ty	pical	Cooling	Chiller	Chiller	Storage	Cooling	Chiller	Chiller	Storage	
	DADB	BANB	Load	Load	Desand	Capacity	Load	Load	Demand	Capacity	
Hour	(F)	(F)	(Ton)	(Ton)	(k₩)	(Ton-Hr)	(Ion)	(Ton)	(kW)	(Ton-Hr)	
1	67.6	65.3	0.0	400.0	374.0	3,426	0.0	400.0	374.0	3,600	
2	66.0	63.9	0.0	400.0	369.6	3,823	0.0	400.0	369.6	3,997	
3	64.6	62.4	0.0	400.0	365.1	4,220	0.0	400.0	365.1	4,394	
4	63.7	61.3	0.0	283.1	239.9	4,500	0.0	109.6	108.1	4,500	
5	63.0	60.8	0.0	0.0	0.0	4,500	0.0	0.0	0.0	4,500	
6	62.8	61.2	0.0	0.0	0.0	4,500	0.0	0.0	0.0	4,500	
7	63.4	61.7	0.0	0.0	0.0	4,500	0.0	0.0	0.0	4,500	
8	65.1	62.3	0.0	0.0	0.0	4,500	0.0	0.0	0.0	4,500	
9	67.6	63.3	0.0	0.0	0.0	4,500	0.0	0.0	0.0	4,500	
10	70.7	65.2	286.9	286.9	191.3	4,500	286.9	286.9	191.4	4,500	
11	74.0	67.5	432.3	432.3	303.5	4,500	432.3	432.3	303.5	4,500	
12	77.1	69.8	557.6	520.0	387.9	4.467	557.6	520.0	387.9	4,462	
13	79.6	71.6	535.2	0.0	0.0	3,924	535.2	0.0	0.0	3,924	

Trane Air Conditioning Economics By: C.D.S. MARKETING

COLD THERMAL STORAGE - ALTERNATIVE 4
11 HOUR ICE BUILD, 10 HOUR CHILLER RUN

				¥e	ekday		Saturday				
	Typ	pical	Cooling	Chiller	Chiller	Storage					
	DADB	DAMB	Load	Load	Demand			Load			
Hour	(F)	(F)	(Ton)	(Ton)		(Ton-Hr)		(Ton)		(Ton-Hr)	
				•	•						
14	81.3	72.7	534.2	0.0	0.0	3,386	534.2	0.0	0.0	3,386	
15	81.8	72.8	561.4	0.0	0.0	2,822	561.4	0.0	0.0	2,822	
16	81.5	73.1	609.6	520.0	398.6	2,733	609.6	520.0	398.6	2,733	
17	81.0	72.7	678.8	520.0	397.3	2,574	678.8	520.0	397.3	2,574	
18	80.0	71.6	665.1	520.0	393.7	2,429	665.1	520.0	393.7	2,429	
19	78.7	71.3	542.0	520.0	392.7	2,407	542.0	520.0	392.7	2,407	
20	77.1	72.0	496.4	496.4	372.7	2,407	496.4	496.4	372.7	2,407	
21	75.3	71.8	448.1	448.1	328.5	2,407	448.1	448.1	328.5	2,407	
22	73.3	71.0	338.5	338.5	238.5	2,407	338.5	338.5	238.5	2,407	
23	71.3	68.9	0.0	400.0	385.6	2,805	0.0	400.0	385.6	2,805	
24	69.4	66.8	0.0	400.0	378.8	3,203	0.0	400.0	378.8	3,203	
									londay		
	Ty	pical			Chiller	•	_			Storage	
	OADB	BWAG	Load	Load	Demand	Capacity		Load		Capacity	
Hour	{F}	{F}	(Ton)	(Ton)	(片片)	{Ton-Hr}	(Ton)	(Ton)	(kW)	(Ton-Hr)	
									774 0	7 700	
1		65.3	0.0		374.0	3,600	0.0			3,500	
2	66.0	63.9	0.0	400.0	369.6	3,997	0.0		369.6	3,997	
3	64.5	62.4	0.0	400.0	365.1	4,394	0.0		365.1	4,394	
4	63.7	61.3	0.0		108.1	4,500	0.0			4,500	
5	63.0	8.03	0.0	0.0	0.0	4,500	0.0	0.0	0.0	4,500	
6	62.8	61.2	0.0		0.0	4,500	0.0	0.0		4,500	
7	63.4	61.7	0.0		0.0	4,500	0.0	0.0		4,500	
8	65.1	62.3	0.0		0.0	4,500	0.0	0.0		4,500	
9	67.6	63.3	0.0			4,500	0.0			4,500	
10	70.7	65.2	286.9			4,500	286.9			4,500	
- 11	74.0	67.5	432.3			4,500	432.3			4,500	
12	77.1	69.8	557.6	520.0	387.9	4,462	557.6			4,462	
13	79.6	71.6	535.2			3,924	535.2			3,924	
14	81.3	72.7	534.2			3,386	534.2			3,386	
15	81.8	72.8	561.4	0.0		2,822	561.4			2,822	
16	91.6	73.1	609.6			2,733	609.6			2,733	
17	81.0	72.7	678.8			2,574	678.8			2,574	
18	80.0	71.6	665.1							2,429	
19	78.7	71.3	542.0			2,407	542.0			2,407	
20	77.1	72.0	496.4	496.4	372.7	2,407	496.4	496.4		-	
21	75.3	71.8	448.1	448.1	328.5	2,407	448.1			2,407	
22	73.3	71.0	338.5	338.5	238.5	2,407	338.5			2,407	
23	71.3	68.9	0.0	400.0	385.6	2,805	0.0			2,805	
24	69.4	66.8	0.0	400.0	378.8	3,203	0.0	400.0	378.8	3,203	
						•					

---- BUILDING COOLING DEMANDS AND THERMAL STORAGE----

July

			Design						
	Desi	ign	Cooling	Chiller	Chiller	Storage			
	DADE	DAWR	Load	Load	Desand	Capacity			
Hour	(F)	(F)	(Ton)	(Ton)	(k¥)	(Ton-Hr)			
- 1	73.4	68.8	0.0	400.0	385.3	3,600			
2	72.3	67.9	0.0	400.0	382.3	3,997			
3	71.4	67.2	0.0	400.0	3B0.0	4,394			
4	70.7	67.0	0.0	109.6	115.7	4,500			
5	70.5	66.9	0.0	0.0	0.0	4,500			
. 6	71.0	67.4	0.0	0.0	0.0	4,500			
7	72.1	68.4	0.0	0.0	0.0	4,500			
8	74.1	69.3	0.0	0.0	0.0	4,500			
9	77.0	70.1	0.0	0.0	0.0	4,500			
10	80.4	71.4	494.4	494.4	369.0	4,500			
11	84.2	73.3	672.3	520.0	399.3	4,348			
12	87.8	75.5	775.6	520.0	406.7	4,092			
13	90.5	76.5	733.0	0.0	0.0	3,356			
14	92.3	76.8	763.3	0.0	0.0	2,590			
15	93.0	77.0	805.4	0.0	0.0	1,782			
16	92.3	76.7	891.8	520.0	410.8	1,411			
17	90.B	75.3	889.6	520.0	406.0	1,041			
18	88.3	74.2	860.2	520.0	402.3	701			
19	85.4	72.9	714.1	520.0	397.9	507			
20	82.4	73.4	680.5	520.0	399.6	346			
21	80.0	73.0	641.2	520.0	398.3	225			
22	77.7	72.3	559.5	520.0	395.9	186			
23	75.9	70.6	0.0	400.0	391.3	585			
. 24	74.6	69.4	0.0	400.0	387.3	985			

				¥e	ekday		Saturday				
	Ty	pical	Cooling	Chiller	Chiller	Storage	Cooling	Chiller	Chiller	Storage	
	DADB	BANB	Load	Load	Demand	Capacity	Load	Load	Demand	Capacity	
Hour	(F)	(F)	(Ton)	(Ton)	(kW)	(Ton-Hr)	(Ton)	(Ten)	(kW)	(Ton-Hr)	
1	74.3	71.0	0.0	400.0	392.7	1,384	0.0	400.0	392.7	2,508	
2	71.9	68.8	0.0	400.0	385.3	1,783	0.0	400.0	385.3	2,906	
3	69.9	67.0	0.0	400.0	379.4	2,182	0.0	400.0	379.4	3,303	
Ą	68.3	65.9	0.0	400.0	375.9	2,580	0.0	400.0	375.9	3,701	
5	67.4	65.2	0.0	400.0	<sup>2</sup> 373.7	2,978	0.0	400.0	373.7	4,098	
6	67.0	64.9	0.0	400.0	372.7	3,375	0.0	400.0	372.7	4,494	
7	67.5	65.3	0.0	400.0	374.0	3,773	0.0	0.0	0.0	4,500	
8	68.8	65.6	0.0	400.0	374.9	4,170	0.0	0.0	0.0	4,500	
9	70.9	65.7	0.0	333.6	300.7	4,500	0.0	0.0	0.0	4,500	
10	73.6	66.5	305.3	305.3	205.9	4,500	305.3	305.3	205.9	4,500	
11	76.7	67.9	454.0	454.0	322.9	4,500	454.0	454.0	322.9	4,500	
12	79.9	69.9	581.5	520.0	388.2	4,438	581.5	520.0	388.2	4,438	
13	83.0	71.3	563.2	0.0	0.0	3,872	563.2	0.0	0.0	3,872	

COLD THERMAL STORAGE - ALTERNATIVE 4 11 HOUR ICE BUILD, 10 HOUR CHILLER RUN

				Ne	ekdav		Saturday				
	Ty	pical	Cooling			Storage					
	DADR	DAMB		Load	Demand	Capacity	Load	Load	Demand	Capacity	
Hour	(F)	(F)				(Ton-Hr)		(Ton)			
			•	( /	, i	(12111111111111111111111111111111111111	( - 2 /	(12.7)	<b>(</b> )	, . <b>.</b> ,	
14	85.7	72.5	597.7	0.0	0.0	3,271	597.7	0.0	0.0	3,271	
15	87.8	73.9	654.3	0.0	0.0	2,614	654.3	0.0	0.0	2,614	
16	89.1	75.3	737.3		405.0	2,397	737.3		406.0	2,397	
17	89.5	75.5	810.6		406.7	2,106	810.6	520.0		2,106	
18	89.2	76.2	803.8		409.1			520.0		1,822	
19	88.3	76.7	700.3		410.8	1,822 1,642	700.3			1,642	
20	86.7	78.6	684.0		417.5	1,478 1,341 1,312	684.0		417.5	1,478	
21	84.7	78.8	656.5		418.2	1.341	656.5			1,341	
22	82.3	78.0	549.7		415.4	1.312	549.7	520.0		1,312	
23	79.6	75.4				1,711	0.0			1,711	
24	76.9	73.0	0.0	400.0	408.1 399.6	2,109	0.0	400.0 400.0	399.6	2,109	
										-,	
				S	unday			M	onday		
	Ty	pical	Cooling	Chiller	Chiller	Storage	Cooling	Chiller	Chiller	Storage	
	DADB	DAWE	Load	Load	Demand	Capacity	Load	Load	Desand	Capacity	
Hour	(F)	(F)	(Ton)	(Ten)	(kW)	Capacity (Ton-Hr)	(Ton)	(Ton)	(k#)	(Ton-Hr)	
								•			
1	74.3	71.0	0.0	400.0	392.7	2,508	0.0	400.0	392.7	2,508	
2	71.9	48.8	0.0	400.0	385.3	2,906	0.0	400.0	385.3	2,905	
3	69.9	67.0	0.0		379.4	3,303	0.0	400.0		3,303	
4	68.3	65.9	0.0		375.9	3,701	0.0	400.0	375.9		
5	67.4	65.2	0.0		373.7	4,098	0.0	400.0	373.7	4,098	
6	67.0	64.9	0.0	400.0	372.7	4,494	0.0			4,494	
7	67.5	65.3	0.0	0.0	0.0	4,500	0.0	0.0	0.0	4,500	
8	8.84	65.6	0.0	0.0	0.0	4,500	0.0	0.0	0.0	4,500	
9	70.9	65.7	0.0	0.0		4,500	0.0	0.0		4,500	
10	73.6	66.5	305.3	305.3		4,500	305.3	305.3	205.9	4,500	
11	76.7	67.9	454.0	454.0		4,500	454.0	454.0	322.9	4,500	
12	79.9	69.9	581.5	520.0	388.2	4,500 4,438	581.5	520.0	388.2	4,438	
13	83.0	71.3	563.2	0.0	0.0	3,872	563.2	0.0	0.0	3,872	
14	85.7	72.5	597.7	0.0	0.0	3,271	597.7	0.0	0.0	3,271	
15	87.8	73.9	654.3	0.0	0.0	2,614	654.3	0.0	0.0	2,614	
16	89.1	75.3	737.3	520.0	405.0	2,397	737.3	520.0	406.0	2,397	
17	89.5	75.5	810.6	520.0	406.7	2,106	810.6	520.0	406.7	2,106	
18	89.2	76.2	803.8	520.0	409.1	1,822	803.8	520.0	409.1	1,822	
19	88.3	76.7	700.3	520.0		1,642	700.3	520.0			
20	86.7	78.6	684.0		417.5	1,478	684.0	520.0			
21	84.7	78.8	656.5	520.0		1,341				1,341	
22	82.3	78.0	549.7		415.4	1,312		520.0			
23	79.6	75.4	0.0		408.1	1,711		400.0		1,711	
24	76.9	73.0	0.0	400.0	399.6	2,109	0.0	400.0	399.6	2,109	

---- BUILDING COOLING DEMANDS AND THERMAL STORAGE----

August

					D	esign	
		Desi	gn	Cooling	Chiller	Chiller	Storage
		DADR	DAMB	Load	Load	Demand	Capacity
H	מער	(F)	(F)	(Ton)	(Ton)	(kW)	(Ton-Hr)
	1	70.5	64.5	0.0	400.0	371.5	2,508
	2	69.5	63.5	0.0	400.0	368.4	2,906
	3	68.7	63.0	0.0	400.0	366.9	3,303
	4	68.1	62.4	0.0	400.0	365.1	3,701
	5	67.9	62.6	0.0	400.0	365.7	4,09B
	6	68.3	63.2	0.0	400.0	367.5	4,494
	7	69.3	64.1	0.0	0.0	0.0	4,500
	8	71.1	64.9	0.0	0.0	0.0	4,500
	9	73.7	66.1	0.0	0.0	0.0	4,500
	10	76.8	67.2	406.9	406.9	282.1	4,500
	11	80.2	68.9	583.6	520.0	385.1	4,436
	12	83.4	70.6	695.3	520.0	390.4	4,261
	13	85.8	71.5	664.3	0.0	0.0	3,593
	14	87.5	72.5	698.6	0.0	0.0	2,892
	15	88.1	72.7	727.3	0.0	0.0	2,162
	16	87.5	71.7	794.2	520.0	394.0	1,888
	17	B6.0	70.6	806.4	520.0	390.4	1,602
	18	83.8	69.7	758.7	520.0	387.6	1,363
	19	81.2	68.5	598.2	520.0	383.9	1,285
	20	78.6	68.7	545.2	520.0	384.5	1,259
-	21	76.4	68.8	454.4	454.4	325.7	1,259
	22	74.3	67.6	321.1	321.1	218.8	1,259
	23	72.7	66.4	0.0	400.0	377.5	1,658
	24	71.5	65.3	0.0	400.0	374.0	2,057
÷ .							

				¥e	ekday					
	Ty	pical	Cooling	Chiller	Chiller	Storage	Cooling	Chiller	Chiller	Storage
	DADR	DANB	Load	Load	Demand	Capacity	Load	Load	Demand	Capacity
Hour	(F)	(F)	(Ton)	(Ton)	(k₩)	(Ton-Hr)	(Ton)	(Ton)	(k₩)	(Ton-Hr)
1	70.1	65.3	0.0	400.0	374.0	2,455	0.0	400.0	374.0	3,739
2	68.2	63.5	0.0	400.0	368.4	2,854	0.0	400.0	368.4	4,136
3	66.6	62.2	0.0	400.0	364.6	3,251	0.0	367.3	327.4	4,500
4	65.4	61.1	0.0	400.0	361.4	3,649	0.0	0.0	0.0	4,500
5	64.6	60.7	0.0	400.0	.360.2	4,046	0.0	0.0	0.0	4,500
6	64.4	60.7	0.0	400.0	360.2	4,442	0.0	0.0	0.0	4,500
7	64.9	61.2	0.0	61.1	79.9	4,500	0.0	0.0	0.0	4,500
8	66.3	61.6	0.0	0.0	0.0	4,500	0.0	0.0	0.0	4,500
9	68.5	62.5	0.0	0.0	0.0	4,500	0.0	0.0	0.0	4,500
10	71.4	63.6	250.5	250.5	166.1	4,500	250.6	250.6	155.1	4,500
11	74.5	65.1	396.0	396.0	268.5	4,500	396.0	396.0	268.5	4,500
12	77.6	66.8	504.8	504.8	364.7	4,500	504.8	504.9	364.7	4,500
13	80.5	68.2	495.1	0.0	0.0	4,001	495.1	0.0	0.0	4,001

Trane Air Conditioning Economics
By: C.D.S. MARKETING

	Weekday						Saturday				
	Ţy	pical				Storage					
	DADR	DAWR	Load	Load		Capacity		Load	Demand		
Hour	(F)	(F)	(Ton)	(Ton)		(Ton-Hr)		(Ton)	(k₩)	(Ton-Hr)	
14	82.7	69.7	525.9	0.0	0.0	3,472	525.9	0.0	0.0	3,472	
15	84.2	70.7	562.3	0.0	0.0	2,907	562.3	0.0	0.0	2,907	
16	84.6	70.5	612.6	520.0	390.1	2,815	612.6	520.0	390.1	2,815	
17	84.4	70.4	668.2	520.0	389.8	2,666	668.2	520.0	389.8	2,666	
18	83.6	70.7	640.3	520.0	390.8	2,546	640.3	520.0	390.8	2,546	
19	82.4	70.7	496.1	496.1	368.4	2,546	495.1	496.1	369.4	2,546	
20	80.8	71.9	476.3	476.3	353.9	2,546	476.3	476.3	353.9	2,546	
21	78.9	72.4	433.7	433.7	317.8	2,546	433.7	433.7	317.8	2,546	
22	76.8	71.1	330.5	330.5	232.9	2,546	330.5	330.5	232.9	2,546	
23	74.5	69.3	0.0	400.0	387.0	2,944	0.0	400.0	387.0	2,944	
24	72.2	67.2	0.0	400.0	380.0	3,342	0.0	400.0	380.0	3,342	
				5	iunday			H	onday		
	Ty	pical	Cooling	Chiller		Storage		Chiller	Chiller		
	DADB	BWAD	Load	Load	Demand	Capacity	Load	Load	Demand	Capacity	
Hour	{F}	(F)	(Ton)	(Ton)	(kW)	(Ton-Hr)	(Ton)	(Ton)	(k#)	(Ton-Hr)	
1	70.1	65.3	0.0	400.0	374.0	3,739	0.0	400.0	374.0	3,739	
2	68.2	63.5	0.0	400.0	368.4	4,136	0.0	400.0	368.4	4,136	
3	66.6	62.2	0.0	367.3	327.4	4,500	0.0	367.3	327.4	4,500	
4	65.4	61.1	0.0	0.0	0.0	4,500	0.0	0.0	0.0	4,500	
5	64.6	60.7	0.0	0.0	0.0	4,500	0.0	0.0	0.0	4,500	
é	64.4	60.7	0.0	0.0	0.0	4,500	0.0	0.0	0.0	4,500	
7	64.9	61.2	0.0	0.0	0.0	4,500	0.0	0.0	0.0	4,500	
9	66.3	61.6	0.0	0.0	0.0	4,500	0.0	0.0	0.0	4,500	
9	48.5	62.5	0.0	0.0	0.0	4,500	0.0	0.0	0.0	4,500	
10	71.4	63.6	250.6	250.6	166.1	4,500	250.6	250.6		4,500	
11	74.5	65.1	396.0	396.0	268.5	4,500	396.0	396.0		4,500	
12	77.6	66.8	504.8	504.8	364.7	4,500	504.8			4,500	
13	80.5	68.2	495.1	0.0	0.0	4,001	495.1		0.0	4,001	
14	82.7	69.7	525.9	0.0	0.0	3,472	525.9		0.0	3,472	
15	84.2	70.7	562.3	0.0		2,907	562.3		0.0	2,907	
16	84.6	70.5	612.6	520.0	390.1	2,815	612.6			2,81	
17	84.4	70.4	668.2	520.0	389.8	2,666	668.2		389.8	2,666	
18	B3.6	70.7	640.3	520.0	390.8	2,546	640.3			2,546	
19	82.4	70.7	496.1	496.1			496.1		368.4	2,54	
20	80.8	71.9	476.3	476.3							
21	78.9	72.4	433.7	433.7							
22	76.8	71.1	330.5	330.5			330.5			2,546	
23	74.5	69.3	0.0	400.0	387.0	2,944	0.0			2,94	
24	72.2	67.2	0.0	400.0	380.0	3,342	0.0	400.0	380.0	3,343	

### ---- BUILDING COOLING DEMANDS AND THERMAL STORAGE----

September

			Design						
	Desi	ign	Cooling	Chiller	Chiller	Storage			
	DADB	DANB	Load	Load	Demand	Capacity			
Hour	(F)	(F)	(Ton)	(Ton)	(kW)	(Ton-Hr)			
1	64.3	60.7	0.0	400.0	360.2	3,739			
2	63.3	59.8	0.0	400.0	357.7	4,136			
3	62.4	59.2	0.0	367.3	319.4	4,500			
4	61.8	58.5	0.0	0.0	0.0	4,500			
5	61.6	58.3	0.0	0.0	0.0	4,500			
6	62.0	58.7	0.0	0.0	0.0	4,500			
7	63.1	59.8	0.0	0.0	0.0	4,500			
8	64.9	61.3	0.0	0.0	0.0	4,500			
9	67.5	62.3	0.0	0.0	0.0	4,500			
10	70.6	63.4	305.6	305.6	200.2	4,500			
11	74.0	65.1	491.7	491.7	348.2	4,500			
12	77.3	66.6	611.3	520.0	378.1	4,409			
13	79.7	68.1	579.7	0.0	0.0	3,825			
14	81.3	68.9	596.3	0.0	0.0	3,226			
15	81.9	69.3	623.8	0.0	0.0	2,600			
16	81.3	8.83	684.1	520.0	384.8	2,436			
17	79.9	68.2	694.6	520.0	382.9	2,261			
18	77.7	67.0	653.5	520.0	379.3	2,128			
19	75.0	66.9	506.2	506.2	366.3	2,128			
20	72.4	66.6	369.5	369.5	251.7	2,128			
21	70.2	65.3	283.2	283.2	189.2	2,128			
22	68.1	63.7	169.8	169.8	122.6	2,128			
23	66.5	62.5	0.0	400.0	365.4	2,526			
24	65.3	61.6	0.0	400.0	362.8	2,924			

				#e	ekday		Saturday					
	Ty	pical	Cooling	Chiller	Chiller	Storage	Cooling	Chiller	Chiller	Storage		
	DADB	DANB	Load	Load	Demand	Capacity	Load	Load	Demand	Capacity		
Hour	(F)	(F)	(Ton)	(Ton)	(k#)	(Ton-Hr)	(Ton)	(Ton)	(k¥)	(Ton-Hr)		
1	63.9	61.5	0.0	400.0	362.5	3,321	0.0	400.0	362.5	4,315		
2	62.0	59.7	0.0	400.0	357.4	3,719	0.0	189.6	158.6	4,500		
3	60.4	58.4	0.0	400.0	353.9	4,116	0.0	0.0	0.0	4,500		
4	59.2	57.1	0.0	387.5	336.4	4,500	0.0	0.0	0.0	4,500		
5	58.4	56.3	0.0	0.0	0.0	4,500	0.0	0.0	0.0	4,500		
6	58.2	56.1	0.0	0.0	0.0	4,500	0.0	0.0	0.0	4,500		
7	58.7	56.7	0.0	0.0	0.0	4,500	0.0	0.0	0.0	4,500		
8	60.1	57.9	0.0	0.0	0.0	4,500	0.0	0.0	0.0	4,500		
9	62.4	58.6	0.0	0.0	0.0	4,500	0.0	0.0	0.0	4,500		
10	65.2	59.6	142.2	142.2	104.3	4,500	142.9	142.9	104.6	4,500		
11	48.3	61.1	275.3	275.3	176.8	4,500	275.3	275.3	176.8	4,500		
12	71.5	62.7	415.0	415.0	277.8	4,500	415.0	415.0	277.8	4,500		
13	74 3	44.4	413.9	0.0	0.0	4.082	414.3	0.0	0.0	4.082		

Trane Air Conditioning Economics By: C.D.S. MARKETING

COLD THERMAL STORAGE - ALTERNATIVE 4
11 HOUR ICE BUILD, 10 HOUR CHILLER RUN

				N-	_1.4			· .		
	7									
	1 7 1	16310	rooting	unilier	unilier	Storage	Cooling	uniller	Chiller	Storage
	DADB	DAWB	1020	1080	Demans	Capacity	1050	Load		
Hour	(F)	(F)	(100)	(ion)	{ k # }	(Ton-Hr)	(Ion)	(Ton)	(	(Ton-Hr)
14		66.0			0.0				0.0	
15	78.0	67.1	465.5	0.0		3,154		0.0		3,154
16	78.5	67.5	514.5	514.5	375.7	3,154	514.5	514.5 520.0	375.7	3,154
17	78.2	67.9	550.9	520.0	382.0	3,154 3,123	550.9	520.0	382.0	3,123
18	77.5	68.0	499.0	499.0		3,123	499.0	499.0	362.9 265.8	3,123
19		69.3	379.7		265.8	3,123	379.7	379.7		3,123
20	74.7	70.0	348.0		243.3	3,123	348.0	348.0	243.3	3,123
21	72.7	69.0			200.9	3,123	290.0	290.0	200.9	
22	70.6	67.3			138.7	3,123	348.0 290.0 190.0	190.0	138.7	
23	68.3	65.4	0.0	400.0	374.3	3,521	0.0	400.0	374.3	3,521
24	66.1	63.6	0.0	400.0	368.7	3,521 3,918	0.0	400.0	368.7	3,918
			-	S	unday			¥	londay	
	7 7	pical	Cooling	Chiller	Chiller	Storage	Cooling	Chiller	Chiller	Storage
	DADB	DANB	Load	Load	Demand	Capacity	Load	Load	De≘and	Capacity
Hour	{F}	{F}	(Ton)	(Ton)	(kW)	(Ton-Hr)	(Ton)	(Ton)	(kW)	(Ton-Hr)
									716.5	4 745
1		61.5	0.0	400.0	362.5	4,315 4,500	0.0	400.0	362.5	4,315 4,500
2	62.0	59.7	0.0	188.9	158.8	4,500	0.0	188.9	158.8	
3	60.4	58.4	0.0		0.0	4,500	0.0	0.0	0.0	4,500
4		57.1	0.0	0.0	0.0	4,500	0.0	0.0	0.0 0.0	4,500
5	58.4	56.3	0.0		0.0	4,500	0.0 0.0	0.0	0.0	
É	58.2	56.1	0.0	0.0	0.0	4,500	0.0 0.0	0.0	0.0	4,500
7	58.7	56.7	0.0		0.0	4,500	0.0	0.0		
8	60.1	57.9	0.0			4,500	0.0	0.0		
9	62.4	58.6	0.0			4,500	0.0	0.0	0.0 104.6	4,500
10	65.2	59.6			104.6	4,500 4,500 4,500	142.9			4,500
11	48.3	61.1	275.3		176.8	7,000	275.3			
12	71.5	62.7	415.0			4,500	415.0	415.0		
13	74.3	64.6	414.3			4,082			0.0	
14	76.6	66.0	456.6		0.0	3,622 3,154	456.6	0.0	0.0	
15	78.0	67.1	465.5	0.0	0.0	3,154				
16	78.5	67.5	514.5		375.7	3,154	514.5	514.5		
17	78.2	67.9	550.9			3,123	550.9	520.0		
18	77.5	68.0	499.0		362.9	3,123	499.0			
19	76.3	69.3	379.7		265.8	3,123	379.7	379.7 348.0	265.8	
20	74.7	70.0	348.0		243.3					
21	72.7	69.0	290.0		200.9	3,123	290.0 190.0 0.0	290.0	200.9 138.7	3,123
22	70.6	67.3		190.0	138.7 374.3	3,123	190.0	190.0	138.7	3,123
23	68.3	65.4	0.0			3,521	0.0	400.0		
24	66.1	63.6	0.0	400.0	368.7	3,918	0.0	400.0	368.7	3,918

#### APPENDIX E

#### DETAILED ENERGY AND DEMAND DEVELOPEMENT AND CALCULATIONS

#### E.1 BASIS OF CALCULATIONS

Individual printouts of each ECO's energy usage (KWH) and component month-by-month peak electrical demand (KW) are contained in Appendix F. Also included therein is the same data for the Base Case of the centrifugal chiller.

The tabulations which follow use this data and data taken from the typical hour-by-hour demand curve for the Fort which was obtained from the utility company to estimate what the electric utility cost difference would be between a given ECO and the Base Case. The electric utility costs incurred are based upon the sum of the energy (KWH) costs and the demand (KW) costs. Each will be explained in turn.

#### a) Energy (KWH) Costs

Energy costs are simple to determine. The various components in the system each consume energy on a continuing basis. This continuous usage is tallied over a given monthly billing period and the resulting KWH total is then multiplied by the cost per KWH to obtain the energy cost. This procedure is independent of when during the day the energy was used. All usage is figured into the energy cost billed.

#### b) Demand (KW) Costs

The logic in calculation of demand costs is different. The factor which will determine a demand charge which appears on a monthly statement is the highest KW demand established over the preceding 12 months. This demand is typically established during mid-afternoons of summer months, when air conditioning systems are under peak loads. Therefore, it is very beneficial to minimize or eliminate KW loads during this period.

Therefore, in order to estimate the effect of a given system alternative on total billing demand it was necessary to estimate what the Fort's hourly base demand is during a peak month (taken as July) and then add to that the demands which would be established by that system's cooling plant. The sum of these at each hour is the total peak demand at that hour. The hour with the greatest demand is then taken as establishing the demand which will be billed for the next 12 months.

Using the historical demand curve previously referenced, the following figures were used to estimate base demand for the Fort during a peak day in July:

	<b>DEMAN</b>
TIME	D (KW)
11 AM	26,600
12 NOON	28,000
1 PM	29,100
2 PM	30,000
3 PM	29,000
4 PM	28,400
5 PM	27,700

#### E.2 BASE CASE PROCEDURES AND RESULTS

Hourly chiller KW demand loads were calculated using a selected machine capacity of 900 tons and applying a part-load efficiency curve to the hourly loads calculated to occur during the design July afternoon period. The chiller was selected to have a peak efficiency of .73 KW per ton, which is a mid-range efficiency selection. Such a selection represents a good value between a high-efficiency chiller and one with a low first cost.

All other system components (pumps, cooling towers), being essentially non-modulating in nature, were taken as establishing their design demand KW throughout the design day afternoon. Energy consumption data were taken directly from the TRACE program output. The following table summarizes this data.

#### I. DEMAND COMPONENT

Hour	1100	1200	1300	1400	1500	1600	1700
Base Demand	26,600	28,000	29,100	30,000	29,000	28,400	27,700
Centr. Chiller	483	567	541	564	597	659	649
Cooling Tower	72	72	72	72	72	72	72
Cond. Water Pu	mps 15	15	15	15	15	15	15
Ch. Water Pump	os 28	28	28	28	28	28	28
	27,198	28,682	29,756	30,679	29,712	29,174	28,464

Demand in excess of peak:

Demand cost over 12 months:

679 KWD

\$50,395 (at \$6.185 per KWD)

#### II. ENERGY COMPONENT

Month	Jun	Jul	Aug	Sept	Total
KWHR usage for: Centr. Chiller	358,950	427,172	365,049	284,634	1,435,805

Annual KWHR Cost:

\$35,895 (at \$.025 per KWHR)

Total Annual Utility Cost: \$86,290

#### E.3 ICE HARVESTER SYSTEM ECO'S

The following five sub-sections present the results of demand and energy usage calculations for each ECO, displays the savings in demand and usage between that ECO and the base case, and applies the appropriate KWD and KWHR unit costs to those savings. A resulting annual utility cost savings is shown at the bottom of each tabulation.

It may be noted that one piece of equipment that is listed in the Appendix F energy and demand tabulations is the "Water Circulating Pump-Constant Volume." This pump only runs during the ice-making mode. Therefore, it is off during the hours from 11:00 a.m. to 5:00 p.m.

#### E.3.1 ECO IH-1

Comments: This system, while producing some demand and energy savings, does not look promising. The total annual savings of \$9,485 is rather insignificant.

#### I. DEMAND COMPONENT

Hour	1100	1200	1300	1400	1500	1600	1700
Base Demand	26,600	28,000	29,100	30,000	29,000	28,400	27,700
630 Ton Chiller	452	461	465	466	467	465	460
Cooling Tower F	ans 50	50	50	50	50	50	5050
Ch. Water Pump	28	. 28	28	28	28	28	28
Cond. Water Pur	mps 11	11	11	11	11	11	11
	28,141	28,550	29,654	30,555	29,556	28,954	28,249

Peak Demand Reduction Compared to Base Case: 124
Annual demand savings at \$6.185 per KWD: \$9,203

#### **II. ENERGY COMPONENT**

Month	Jun	Jul	Aug	Sept	Annual
KWHR usage for:					
630 Ton Chiller Base case	350,261 358,950	438,155 427,172	361,489 365,049	274,636 284,634	1,424,541 1,435,805
Savings Compared to Base Case	8,689	-10,983	3,560	9,998	11,264
Annual energy savings @	② \$0.25 per KW	/HR		\$282	

TOTAL ANNUAL UTILITY COST SAVINGS FOR THIS ECO: \$9,485

#### E.3.2 ECO IH-2

Comments: Significant improvement over ECO IH-1, due to the peak KWD reduction resulting from the chiller, cooling tower, and condenser water pumps being turned off at the peak hour. There is, however, an increase in energy usage due to the size of the ice making chillers and the fact that it takes more energy to make ice than to chill water.

#### I. DEMAND COMPONENT

Hour 1100	1200	1300	1400	1500	1600	1700
Base demand 26,600	28,000	29,100	30,000	29,000	28,400	27,700
1,150 Ton Chiller 455	. 0	0	0	0	0	0
Cooling Tower Fans 92	2 0	0	0	0	0	0
Ch. Water Pump 28	3 28	28	28	28	28	28
Cond. Water Pump 20	0	0	. 0	0	0	0
27,195	28,028	29,128	30,028	29,028	28,428	27,728

Peak Demand reduction Compared to Base Case: 651 Annual Demand Savings at \$6.185 per KWD: \$48,317

#### II. ENERGY COMPONENT

Month	Jun	Jul	Aug	Sept	Annual
KWHR usage for:					
1,150 Ton Chiller Base case	394,773 358,950	493,612 427,172	423,914 365,049	333,373 284,634	1,645,672 1,435,805
Savings Compared to Base Case	-35,823	-66,440	-58,865	-48,739	-209,867
Annual energy savings @ \$	0.25 per KW	'HR		(\$5,247)	

TOTAL ANNUAL UTILITY COST SAVINGS FOR THIS ECO: \$43,071

#### E.3.3 ECO IH-3

Comment: This system results in less energy savings than ECO IH-1. More energy is consumed because four hours of operation were shifted to ice-making from water chilling. As noted in the previous paragraph, ice-making uses more energy than water chilling. At the same time, the shift in usage did not produce a meaningful increase in KWD reduction.

#### I. DEMAND COMPONENT

Hour 1100	1200	1300	1400	1500	1600	1700
Base Demand 26,600	28,000	29,100	30,000	29,000	28,400	27,700
625 Ton Chiller 449	. 457	461	462	463	462	462
Cooling Tower Fans 50	50	50	50	50	50	50
Ch. Water Pump 28	28	28	28	28	28	28
Cond. Water Pump 11	11	11	. 11	11	11	11
27,138	28,546	29,650	30,551	29,552	28,951	28,251

Peak Demand Reduction Compared to Base Case:	128
Annual Demand Savings at \$6.185 per KWD:	\$9,500

#### II. ENERGY COMPONENT

Month	Jun	Jul	Aug	Sept	Annual
KWHR usage for:					
625 Ton Chiller	354,982	460,020	359,978	275,994	1,405,974
Base Case	358,950	427,172	365,049	284,634	1,435,805
Savings Compared					
to Base Case:	3,968	-32,848	5,071	8,640	-15,169
Annual Energy Savings at	\$.025 per KV	VHR:	(\$379)		
Annual utility cost savings	for this ECO	:	\$9,121		

#### E.3.4 ECO IH-4

Comments: The results of this system compared to ECO IH-2 are very similar to the results of ECO IH-3 compared to ECO IH-1. There is a very small reduction in energy savings which results from shifting four hours of water chilling to ice-building. This is again due to the relative energy inefficiency of ice building, as compared to water chilling. Demand reduction, on the other hand, did not change.

#### I. DEMAND COMPONENT

Hour 1100	1200	1300	1400	1500	1600	1700
Base Demand 26,600	28,000	29,100	30,000	29,000	28,400	27,700
975 Ton Chiller 454	0	0	0	0	0	0
Cooling Tower Fans 78	0	0	0	0	0	0
Ch. Water Pump 28	28	28	. 28	28	28	28
Cond. Water Pump 16	0	0	0	0	0	0
27,176	28,028	29,128	30,028	29,028	28,028	27,728

Peak Demand Reduction Compared to Base Case: 651
Annual Demand Savings at \$6.185 per KWD: \$48,317

#### II. ENERGY COMPONENT

Month	Jun	Jul	Aug	Sept	Annual
KWHR usage for:					
975 Ton Chiller Base Case	398,148 358,950	505,719 427,172	426,572 365,049	322,145 284,634	1,652,584 1,435,805
Savings Compared to Base Case:	-39,198	-78,547	-61,523	-37,511	-216,779
Annual Energy Savings at	\$.025 per KV	VHR:		(\$5,419)	

TOTAL ANNUAL UTILITY COST SAVINGS FOR THIS ECO: \$42,898

#### E.3.5 ECO IH-5

Comments: As might be expected, the narrowing of the demand "window" during which ice must be available to carry load from six hours to three hours results in the greatest energy savings. This is because less ice-making time at night is needed and, therefore, ice-making inefficiencies are minimized.

#### I. DEMAND COMPONENT

Hour 1100	1200	1300	1400	1500	1600	1700
Base Demand 26,600	28,000	29,100	30,000	29,000	28,400	27,700
820 Ton Chiller 463	560	0	0	0	606	599
Cooling Tower Fans 66	66	0	0	0	66	66
Ch. Water Pump 28	28	28	28	28	28	28
Cond. Water Pump 14	14	0	. 0	0	14	14
27,171	28,668	29,128	30,028	29,028	29,114	28,407

Peak Demand Reduction Compared to Base Case: 651
Annual Demand Savings at \$6.185 per KWD: \$48,317

#### II. ENERGY COMPONENT

Month	Jun	Jul	Aug	Sept	Annual			
KWHR usage for:								
820 Ton Chiller	358,977	453,487	379,911	297,877	1,490,252			
Base Case	358,950	427,172	365,049	284,634	1,435,805			
Savings Compared								
to Base Case:	-27	-26,315	-14,862	-13,243	-54,447			
Annual Energy Savings at \$.025 per KWHR:								
TOTAL ANNUAL UTILITY COST SAVINGS FOR THIS ECO:								

#### **E.3.6 SUMMARY TABLE**

ECO	Utility Savings red to Base Case
IH-1	\$ 9,485
IH-2	\$ 43,071
IH-3	\$ 9,121
IH-4	\$ 42,898
IH-5	\$ 46,956

#### E.4 ICE TANK SYSTEM ECO'S:

The following sub-sections are arranged in the same manner as those in Section E.3. Inasmuch as the components associated with the night chiller system only run at night, none of them (the chiller, cooling tower, condenser water pump) are listed in the demand tabulations.

#### E.4.1 ECO IT-1

Comments: Savings achieved by this system are rather modest, due to the fact that no equipment is turned off during the peak demand period. Demand reduction, though, is better than that achieved by the similar Ice Harvester System IH-1. Annual savings achieved by this ECO amount of \$15,200.

#### I. DEMAND COMPONENT

Hour 1100	1200	1300	1400	1500	1600	1700
Base demand 26,600	28,000	29,100	30,000	29,000	28,400	27,700
500 Ton Chiller 384	. 391	394	395	396	395	390
Cooling Tower Fans 41	41	41	41	41	41	41
Ch. Water Pump 28	28	28	28	28	28	28
Cond. Water Pump 14	. 14	14	. 14	14	14	14
27,067	28,474	29,577	30,478	29,479	28,878	28173

Peak Demand Reduction Compared to Base Case: 201
Annual Demand Savings at \$6.185 per KWD: \$14,918

#### II. ENERGY COMPONENT

Month	Jun	Jul	Aug	Sept	Annual			
KWHR usage for:								
500 Ton Chiller	350,261	438,155	361,489	274,636	1,424,541			
Base Case	358,950	427,172	365,049	284,634	1,435,805			
Savings Compared								
to Base Case:	8,689	-10,983	3,560	9,998	11,264			
Annual Energy Savings at \$.025 per KWHR:								
TOTAL ANNUAL UTILITY COST SAVINGS FOR THIS ECO: \$15,200								

#### E.4.2 ECO IT-2

Comments: This shows that shifting the schedule to make more hours available for ice production with the resultant downsizing of the afternoon chiller load does have a beneficial effect. Savings increased from the \$15,200 of ECO IT-1 to almost \$20,000. Significant peak demand costs, however, are still incurred.

#### I. DEMAND COMPONENT

Hour 1100	1200	1300	1400	1500	1600	1700
Base Demand 26,600	28,000	29,100	30,000	29,000	28,400	27,700
450 Ton Chiller 346	. 352	355	356	356	356	351
Cooling Tower Fans 37	37	37	37	37	37	37
Ch. Water Pump 28	28	28	28	28	28	28
Cond. Water Pump 14	14	14	· 14	14	14	14
27,025	28,431	29,534	30,435	29,435	28,835	28,130

Peak Demand Reduction Compared to Base Case: 244
Annual Demand Savings at \$6.185 per KWD: \$18,110

#### II. ENERGY COMPONENT

Month	Jun	Jul	Aug	Sept	Annual		
KWHR usage for:							
450 Ton Chiller Base Case	328,168 358,950	426,614 427,172	350,686 365,049	256,216 284,634	1,361,684 1,435,805		
Savings Compared to Base Case:	30,782	558	14,363	28,418	74,121		
Annual Energy Savings at \$.025 per KWHR:							
TOTAL ANNUAL UTILITY COST SAVINGS FOR THIS ECO: \$1							

#### E.4.3 ECO IT-3

Comments: This option clearly demonstrates the importance of eliminating all peak demands. In turning off the chilling plant during the projected peak demand hours, annual energy savings jumped from the \$15,200 figure of ECO IT-1 to almost \$49,000.

#### I. DEMAND COMPONENT

Hour 1100	1200	1300	1400	1500	1600	1700
Base Demand 26,600	28,000	29,100	30,000	29,000	28,400	27,700
810 Ton Chiller 496	0	0	0	0	0	0
Cooling Tower Fans 66	. 0	0	0	0	0	0
Ch. Water Pump 28	28	28	28	28	28	28
Cond. Water Pump 20	0	0	0	0	0	0
			,			
27,210	28,028	29,128	30,028	29,028	28,428	27728

Peak Demand Reduction Compared to Base Case: 651
Annual Demand Savings at \$6.185 per KWD: \$48,317

#### II. ENERGY COMPONENT

Month	Jun	Jul	Aug	Sept	Annual
KWHR usage for:					
810 Ton Chiller Base Case	336,084 358,950	435,802 427,172	366,197 365,049	288,333 284,634	1,426,416 1,435,805
Savings Compared to Base Case:	22,866	-8,630	-1,148	-3,699	9,389
Annual Energy Savings at		\$235			

TOTAL ANNUAL UTILITY COST SAVINGS FOR THIS ECO: \$48,552

#### E.4.4 ECO IT-4

Comments: This option of keeping the same amount of afternoon off hours while lengthening the amount of time during which ice could be made showed a very marginal improvement in savings over ECO IT-3. Annual savings increased by less than \$1,000, to roughly \$49,400.

#### I. DEMAND COMPONENT

Hour 1100	1200	1300	1400	1500	1600	1700
Base Demand 26,600	28,000	29,100	30,000	29,000	28,400	27,700
635 Ton Chiller 456	0	0	0	0	0	0
Cooling Tower Fans 51	. 0	0	0	0	0	0
Ch. Water Pump 28	28	28	28	28	28	28
Cond. Water Pump 17	0	0	0	0	0	0
27,152	28,028	29,128	30,028	29,028	28,428	27,728

Peak Demand Reduction Compared to Base Case: 651
Annual Demand Savings at \$6.185 per KWD: \$48,317

#### II. ENERGY COMPONENT

Month	Jun	Jul	Aug	Sept	Annual
KWHR usage for:					
635 Ton Chiller Base Case	328,844 358,950	430,629 427,172	358,020 365,049	276,736 284,634	1,394,229 1,435,805
Savings Compared to Base Case:	7,898	41,576			
Annual Energy Savings at STOTAL ANNUAL UTILIT	\$1,039 \$49,357				

#### E.4.5 ECO IT-5

Comments: As might be expected, the "best case" approach of being able to shut down all systems only during three hours in the afternoon allowed the best annual savings to be achieved, approaching \$50,000.

#### I. DEMAND COMPONENT

Hour 1100	1200	1300	1400	1500	1600	1700
Base Demand 26,600	28,000	29,100	30,000	29,000	28,400	27,700
520 Ton Chiller 399	407	0	0	0	411	406
Cooling Tower Fans 42	. 42	0	0	0	42	42
Ch. Water Pump 28	28	28	28	28	28	28
Cond. Water Pump 16	16	0	0	0	16	16
27,085	28,493	29,128	30,028	29,028	28,897	28,192

Peak Demand Reduction Compared to Base Case: 651
Annual Demand Savings at \$6.185 per KWD: \$48,317

#### II. ENERGY COMPONENT

Month	Jun	Jul	Aug	Sept	Annual
KWHR usage for:					
520 Ton Chiller Base Case	330,432 358,950	430,572 427,172	355,477 365,049	269,063 284,634	1,385,544 1,435,805
Savings Compared					
to Base Case:	28,518	-3,400	9,572	15,571	50,261
Annual Energy Savings at	\$.025 per KV	/HR:			\$1,257
TOTAL ANNUAL UTIL	TY COST SA	VINGS FOR	THIS ECO:		\$49,574

### APPENDIX F

ENERGY USAGE AND
PEAK DEMAND
COMPUTER PRINTOUTS

# BASE CASE CENTRIFUGAL CHILLER

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 3 CONVENTIONAL CENTRIFUGAL CHILLER SYSTEM

	ELEC	DEMAND	
	On Peak	On Peak	WATER
Month	(kWh)	(kW)	(1000 61)
Jan	0	0	0
Feb	0	0	0
March	0	0	0
April	0	0	0
Hay	0	0	0
June	358,950	897	955
July	427,172	969	1,298
Aug	365,049	873	951
Sept	284,634	775	641
Oct	. 0	0	0
Nov	0	0	0
Dec	0	0	0
Total	1,435,804	969	3,855

Building Energy Consumption = 17,054 (Btu/Sq Ft/Year)
Source Energy Consumption = 51,168 (Btu/Sq Ft/Year)

Floor Area = 287,340 (Sq Ft)

EQUIPMENT ENERGY CONSUMPTION - ALTERNATIVE 3 CONVENTIONAL CENTRIFUGAL CHILLER SYSTEM

ρf	Equip -					Moni	thly Con	sumption						
	Code	Jan	Feb	Mar	Apr	May	June	July			Oct	Nov	Dec	Total
0	LIGHTS													
	ELEC	0	0	0	0	0		101575		98298	0	0	0	399,74
	PK	0.0	0.0	0.0	0.0	0.0	250.0	250.0	250.0	250.0	0.0	0.0	0.0	250.0
1	MISC LD													
	ELEC	0	0	0	0	0.0	0.0	0.0	0	0	0	0	0	
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.
2	MISC LD													
	6AS	0	0	0	0	0.0	0	0	0	0	0	0	0	
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.
3	MISC LD													
	DIL	0	0	0	0	0	0	0	0	0	0	0	0	_
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.
4	MISC LD													
	P STEAM	0	0	0	0	0	0	0	0	0	0	0	0	
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.
5	MISC LD												•	
	P HOTH20	0	0	0	0	0	0	0	0	0	0	0	0	
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
ó	MISC LD													
	P CHILL	0	0	0	0	0	0	0	0	0	0	0	0	0
	PK	0.0	- 0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	v
1	E01001L			TG CENTR						440440				715 /
	ELEC	0	0	0	0				177143		0	0	0	712,6
	PK	0.0	0.0	0.0	0.0	0.0	565.7	657.3	551.6	453.2	0.0	0.0	0.0	657
1	E05100			ING TOWE										467.6
	ELEC	0		0			51867	53596	53596	38148	0	0	0	197,2
	PK	0.0	0.0	0.0	0.0	0.0	72.0	72.0	72.0	72.0	0.0	0.0	0.0	72
1	E95100			ING TOWE				•			_			• •
	WATER	0	0	0	0	0	955		961	641	0	0	0	3,8
	PK	0.0	0.0	0.0	0.0	0.0	3.1	3.5	3.1	2.6	0.0	0.0	0.0	3
1	E85001			LED WATE	R PUMP -		ANT VOL							65.5
	ELEC	0	0	0	0	0	20160	20832	20832	18480	0	0	0	80,
	PK	0.0	0.0	0.0	0.0	0.0	28.0	28.0	28.0	28.0	0.0	0.0	0.0	28

Trane Air Conditioning Economics By: C.D.S. MARKETING

EQUIPMENT ENERGY CONSUMPTION - ALTERNATIVE 3
CONVENTIONAL CENTRIFUGAL CHILLER SYSTEM

				E 0	UIPH	ENT	ENE	REY	CONSU	HPTI	0 N			
Ref	Equip					Hon	thly Con	sumption						
	Code	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Total
1	E95010		COND	enser Wa	TER PUMP	-CV(HI6	H EFFIC.	)						
	ELEC	0	0	0	0	0	10800	11160	11160	9900	0	0	0	43,020
	PK	0.0	0.0	0.0	0.0	0.0	15.0	15.0	15.0	15.0	0.0	0.0	0.0	15.0
1	E95300		CONT	ROL PANE	L & INTE	RLOCKS								
	ELEC	0	()	0	0	0	720	744	744	660	Û	()	0	2,868
	PK.	0.0	0.0	0.0	0.0	0.0	1.0	1.0	1.0	1.0	0.0	0.0	0.0	1.0

## ECO IH-1

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 1 8 HOUR ICE BUILD, 16 HOUR CHILLER RUN

	ELEC	DEMAND	
	On Peak	On Peak	WATER
Month	(kWh)	(FM)	(1000 61)
Jan	0	0	0
Feb	0	0	0
Harch	0	0	0
April	()	0	0
May	0	0	0
June	350,261	749	976
July	438,155	782	1,361
Aug	361,489	763	1,012
Sept	274,636	730	645
Oct	0	0	0
Nov	()	0	0
Dec	0	0	0
Total	1,424,541	782	3,993

Building Energy Consumption = 16,921 (Btu/Sq Ft/Year)
Source Energy Consumption = 50,767 (Btu/Sq Ft/Year)

Floor Area = 287,340 (Sq Ft)

EQUIPMENT ENERGY CONSUMPTION - ALTERNATIVE 1 8 HOUR ICE BUILD, 16 HOUR CHILLER RUN

ı f	Equip					Hont	hly Cons	sumption						
	Code	Jan	Feb	Har	Apr	May	June	July	Auş	Sep	0ct	Nov	Dec	Tota
0	LIGHTS							404575	4/14575	00000	^	4	٨	399,74
	ELEC	0	0	0	0	0		101575		98298	0	0	()	
	PK	0.0	0.0	0.0	0.0	0.0	250.0	250.0	250.0	250.0	0.0	0.0	0.0	250.4
1	MISC LD								٨			٥	٨	
	ELEC	0	()	0	0	0	0	0	0	0	0	0	0	0.
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	ν.
2	MISC LD							_						
	BAS	0	0	0	0	0	0	()	0	0	0	0	0	
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.
3	MISC LD								_				•	
	OIL	Đ.	0	0	. 0	0	0	0	0	0	0	0	0	
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
4	MISC LD												•	
	P STEAM	0	0	0	()	0	0	0	0	0	0	0	0	
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
5	MISC LD										٨	٨	0	
	Р НОТН20	0	()	0	0	0	0	0	0	0	0	0		(
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	`
6	MISC LD						A	۸	٨	ć,	0	0	0	
	P CHILL PK	0.0	0.0	0.0	0.0	0.0	0 0.0	0.0		0.0	0.0	0.0	0.0	(
		V. V												
1	E01001L			TE CENTR					451555	115554		Δ.	٨	745,
	ELEC	0	0	0	0		180654			115924	0	0	0	
	PK	0.0	0.0	0.0	0.0	0.0	456.8	476.6	454.0	435.9	0.0	0.0	0.0	470
1	E@5100			ING TOWE			2:747	77517	775(7	27417		٨	0	138,
	ELEC	0			0		36307	37517			()	0		5
	PK	0.0	0.0	0.0	0.0	0.0	50.4	50.4	50.4	50.4	0.0	0.0	0.0	J
1	EB5100			ING TOKE					4010				0	3,4
	WATER	0	0	0	0	0	976				0	0.		ى و
	PK	0.0	0.0	0.0	0.0	0.0	2.4	2.4	2.4	2.4	0.0	0.0	0.0	
1	E95001			LED WATE	R PUMP -		TANT VOL							
	ELEC	0	0	0	0	0	20160			19320	0	0 -	0	81,
	PK	0.0	0.0	0.0	0.0	0.0	28.0	28.0	28.0	28.0	0.0	0.0	0.0	2

Trane Air Conditioning Economics By: C.D.S. MARKETINS

EQUIPMENT ENERGY CONSUMPTION - ALTERNATIVE 1 B HOUR ICE BUILD, 16 HOUR CHILLER RUN

				E B	UIPK	ENT	ENER	G Y C	ONSU	HPT1	0 N			
Rof	Equip					Mont	hly Cons	umption						
	Code	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Total
1	EQ5010		COND	ENSER WA	TER PUMP	-CV(HIGH	EFFIC.)							
	ELEC	0	0	0	0	0	7560	7812	7812	7245	0	Ü	0	30,429
	PK	0.0	0.0	0.0	0.0	0.0	10.5	10.5	10.5	10.5	0.0	0.0	0.0	10.5
. 1	E95300		CONT	ROL PANE	L & INTE	RLDCKS								
	ELEC	0	0	0	0	0	720	744	744	690	0	0	0	2,898
	PK	0.0	0.0	0.0	0.0	0.0	1.0	1.0	1.0	1.0	0.0	0.0	0.0	1.0
1	E05013		WATE	R CIRCUL	ATING PU	MP - COI	STANT VO	DLUME						
	ELEC	0	0	0	0	0	6562	6781	6781	5742	0	0	0	25,866
	PK	0.0	0.0	0.0	0.0	0.0	27.3	27.3	27.3	27.3	0.0	0.0	0.0	27.3

## ECO IH-2

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 2 8 HOUR ICE BUILD, 10 HOUR CHILLER RUN

	ELEC	DEMAND	
	On Peak	On Peak	WATER
Month	(kWh)	(k#)	(1000 61)
Jan	0	0	0
Feb	0	0	0
March	0	0	0
April	0	0	0
May	0	0	0
June	394,773	1,051	966
July	493,612	1,269	1,396
Aug	423,914	1,137	1,071
Sept	333,373	1,034	727
Dct	0	0	0
Nov	0	0	0
Dec	0	0	. 0
Total	1,645,672	1,269	4,160

Building Energy Consumption = 19,547 (Btu/Sq Ft/Year)
Source Energy Consumption = 58,647 (Btu/Sq Ft/Year)

Floor Area = 287,340 (Sq Ft)

Trane Air Conditioning Economics By: C.D.S. MARKETING

EDUIPMENT ENERGY CONSUMPTION - ALTERNATIVE 2 8 HOUR ICE BUILD, 10 HOUR CHILLER RUN

	Eauin					Ħnn+	hly Cons	HESTION.						
	Equip Code	Jan	Feb	Mar	Apr	May	June	July		Sep	Oct	Nov	Dec	Total
0	LIGHTS													700 745
	ELEC	0	0	0	0	0	98298		101575	98298	0	0	0	399,745
	PK	0.0	0.0	0.0	0.0	0.0	250.0	250.0	250.0	250.0	0.0	0.0	0.0	250.0
1	MISC LD								4	6	٨	4	0	
	ELEC	0	0	0	0	0	0	0	0	0	0	0.0	0.0	0.
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	V.
2	MISC LD					_			^	٨	۸	6	0	
	BAS	0	0	0	Ø	0	0	0	0	0	0	0		0.
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.
3	MISC LD													
	OIL .	0	0	0	. 0	0	0	0	0	0	0	0	0	0.
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	V.
4	MISC LD									٨	٨			
	P STEAM	0	0	0	0	0	0	0	0	0	0	0	0	0
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	V.
5	MISC LD								ñ	ħ	0	0	0	
	Р НОТН20	0	0	0	0	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	V. V	0.0	·
6	HISC LD			٨	۸		۸	0	0	0	0	0	0	
	P CHILL	0		0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
-	PK	0.0	0.0	0.0	0.0	0.0	0.0	V.V	0.0	4.4	0.0	010	***	•
	E01001L			TE CENTR				≀S 295889	772101	157929	0	0	0	883,4
	ELEC	0	0	0	0	0.0	828.4	869.7	828.4	803.2	0.0	0.0	0.0	869
	PK	0.0	0.0	0.0	0.0	0.0	010.4	997.7	92017	00012	V . V	***		
1	E95100			ING TOWE		0	49705	51362	51362	38126	Û	0	0	190,5
	ELEC	0			0							0.0		92
	PK	0.0	0.0	6.0	0.0	0.0	92.0	12.0	72.0	12.0	0.0		770	
1	E05100			ING TOWE		4	011	1396	1071	727	0	0	0	4,1
	WATER	0	0	0	0	0	966 3.6				0.0	0.0	0.0	,,,
	PK	0.0	0.0	0.0	0.0	0.0	3.0	3.0	٥.5	3.0		V.V	0.0	•
1	E05001		CHIL	LED WATE	R PUMP	- CONST	TANT VOL							
_	ELEC	0	0	0	0	0	20160				0	0	0	80,7
	PK	0.0	0.0	0.0	0.0	0.0	28.0	28.0	28.0	28.0	0.0	0.0	0.0	28

Trane Air Conditioning Economics By: C.D.S. MARKETINS

EQUIPMENT ENERGY CONSUMPTION - ALTERNATIVE 2 8 HOUR ICE BUILD, 10 HOUR CHILLER RUN

				E 0	UIPM	ENT	ENE	8 6 Y 1	CONSU	MPTI	0 N			
Ref	Equip					Honi	thly Con	sumption						
Num	Code	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Total
1	E05010		COND	ENSER WA	TER PUMP	-CV(HIG	H EFFIC.	)						
	ELEC	0	0	0	0	0	10530	10881	10881	9672	0	0	0	41,964
	PK	0.0	0.0	0.0	0.0	0.0	19.5	19.5	19.5	19.5	0.0	0.0	0.0	19.5
1	E05300		CONT	ROL PANE	L & INTE	RLOCKS								
	ELEC	0	0	0	0	0	720	744	744	676	0	0	()	2,884
	PK	0.0	0.0	0.0	0.0	0.0	1.0	1.0	1.0	1.0	0.0	0.0	0.0	1.0
1	E95013		WATE	R CIRCUL	ATING PU	MP - CO	NSTANT V	OLUME						
	ELEC	0	0	0	0	0	11931	12329	12329	9744	0	0	0	46,333
	PK	0.0	0.0	0.0	0.0	0.0	49.7	49.7	49.7	49.7	0.0	0.0	0.0	49.7

## ECO IH-3

Trane Air Conditioning Economics By: C.D.S. MARKETINE

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 3 12 HOUR ICE BUILD, 12 HOUR CHILLER RUN

	ELEC	DEMAND	
	On Peak	On Peak	WATER
Honth	(kWh)	(kW)	(1000 El)
Jan	0	0	0
Feb	0	0	0
Harch	0	0	0
April	0	0	0
May	0	0	0
June	354,982	745	960
July	460,020	778	1,378
Aug	359,978	759	969
Sept	275,994	730	636
Oct	0	0	0
Nov .	()	0	0
Bec	0	0	. 0
Total	1,450,974	778	3,943

Building Energy Consumption = 17,235 (Btu/Sq Ft/Year)
Source Energy Consumption = 51,709 (Btu/Sq Ft/Year)

Floor Area = 287,340 (Sq Ft)

Trans Air Conditioning Economics By: C.D.S. MARKETING

EDUIPMENT ENERGY CONSUMPTION - ALTERNATIVE 3 12 HOUR ICE BUILD, 12 HOUR CHILLER RUN

										MPT1				
Ref	Equip -								A	r	D-4	line:	Dec	Total
Nus	Code	Jan	Feb	Mar	Apr	Hay	June	July	Aug	Sep	Oct	Nov	DEL	10131
0	LIGHTS									20200			0	399,745
	ELEC	0	0	0	0	0			101575	98298	0	0	0	250.0
	PK	0.0	0.0	0.0	0.0	0.0	250.0	250.0	250.0	250.0	0.0	0.0	0.0	230.0
- 1	MISC LD													
	ELEC	0	0	0	0	0	0	0	()	0	0	0	0	0
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	MISC LD													
_	BAS	0	0	0	0	0	0	0	0	0	0	0	0	0
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
. 3	MISC LD													
	DIL	Ō	0	0	. 0	0	0	0	0	()	0	0	0	0
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	MISC LD													4
	P STEAM	0	0	0	0	0	0	0	0	Ű	0	0	0	0.0
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	MISC LD											٨	0	0
	P HOTH20	0	0	0	0	0	0	0	0	0	0	0.0	0.0	0.0
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	v.v	0.0	410
6	MISC LD								٥	٨	0	0	0	0
	P CHILL	0	0	Ü	0	0	0	0		0.0	0.0	0.0	0.0	0.0
-	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	Viv	0.0	***
 1	E01001L				IIFUGAL C	HILLER	>550 TO	45	454155	114203	۸	0	0	759,978
	ELEC	0	0	0	0			281667			0	0.0	0.0	504.8
	PK	0.0	0.0	0.0	0.0	0.0	474.9	504.8	477.4	433.1	0.0	0.0	0.0	50716
1	E95100			ING TOWS				****	77040	07015	٨	٨	0	137,672
	ELEC	0	0	0	0	0	36019	37219	37219	27215	0	0		50.0
	PK	0.0	0.0	0.0	0.0	0.0	50.0		50.0	50.0	0.0	0.0	0.0	20.0
1	E95100			ING TOW					0.0	,7,	٨	0	0	3,943
	WATER	0	0	0	0	0					9	0.0		2.4
	PK	0.0	0.0	0.0	0.0	0.0	2.4	2.4	2.4	2.4		0.0	V.V	427
:	1 E05001				ER PUMP		TANT VOL		51575	10700	۸	٨	0	81,144
	ELEC	0	0	0	0	0					0	0	0.0	28.0
	PK	0.0	0.0	0.0	0.0	0.0	28.0	28.0	28.0	28.0	0.0	0.0	V.V	20.0

Trane Air Conditioning Economics By: C.D.S. MARKETING

EQUIPMENT ENERGY CONSUMPTION - ALTERNATIVE 3 12 HOUR ICE BUILD, 12 HOUR CHILLER RUN

				E Q	UIPM	ENT	ENER	8 Y (	DNSU	MPTI	D N			
Da4	Equip					Mont	hly Cons	umption						
	Code	Jan	Feb	Ħar	Apr	Hay	June	July	Aug	Sep	Oct	Nov	Dec	Total
1	EB5010	1010 CONDENSER WATER PUMP-CV(HISH EFFIC.)												
•	ELEC	0	0	0	0	0	7560	7812	7812	7245	0	0	0	30,429
	PK	0.0	0.0	0.0	0.0	0.0	10.5	10.5	10.5	10.5	0.0	0.0	0.0	10.5
1	E95300		CONT	ROL PANE	L & INTE	RLOCKS								2 200
-	ELEC	0	0	0	0	0	720	744	744	690	0	0	()	2,898
	PK	0.0	0.0	0.0	0.0	0.0	1.0	1.0	1.0	1.0	0.0	0.0	0.0	1.0
1	E05013		WATE	R CIRCUL	ATING PU	MP - COM	ISTANT VI	DLUME						75 000
•	ELEC	0	0	0	0	0	9843	10171	10171	9023	0	0	0	39,209
	PK	0.0	0.0	0.0	0.0	0.0	27.3	27.3	27.3	27.3	0.0	0.0	0.0	27.3

## ECO IH-4

Trane Air Conditioning Economics By: C.D.S. MARKETINS

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 4 12 HOUR ICE BUILD, 6 HOUR CHILLER RUN

MONTHLY ENERGY CONSUMPTION-----

	ELEC	DEMAND	
	On Peak	On Peak	WATER
Menth	(kWh)	(kW)	(1000 61)
Jan	()	0	0
Feb	0	0	0
March	0	0	0
April	0	0	0
May	0	0	0
June	398,148	1,048	987
July	505,719	1,117	1,412
Aug	426,572	1,051	1,079
Sept	322,145	1,030	724
Dct	0	0	0
Nov	0	0	0
Dec	. 0	0	. 0
Total	1,652,584	1,117	4,202

Building Energy Consumption = Source Energy Consumption =

19,629 (Btu/Sq Ft/Year) 58,894 (Btu/Sq Ft/Year) Floor Area = 287,340 (Sq Ft)

Trane Air Conditioning Economics By: C.D.S. MARKETING

EQUIPMENT ENERGY CONSUMPTION - ALTERNATIVE 4 12 HOUR ICE BUILD, 6 HOUR CHILLER RUN

2-4	Equip					Moni	bly Con-	sumption						
	Code	Jan	Feb	Har	Apr	May	June	July		Sep	Oct	Nov	Dec	Total
0	LIGHTS									50005			4	399,745
	ELEC	O	0	0	0	0		101575		98298	0	0	0	250.0
	PK	0.0	0.0	0.0	0.0	0.0	250.0	250.0	250.0	250.0	0.0	0.0	0.0	230.0
1	MISC LD						٨	4	^	٨	^	0	6	0
	ELEC	0	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	V.V	V.V	0.0	A*0	0.0	***
2	MISC LD						٨	٨	٨	0	0	0	0	(
	SAS	0	0	0	0	0	()	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	V.V
3	MISC LD								٨	٨	۸	٨	0	(
	OIL	0	0	0	. 0	0	0	0	0.0	0.0	0.0	0.0	0.0	0.4
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	v.v	0.0	0.0	0.0	Ves
4	MISC LD				_					۸	٨	0	Û	•
	P STEAM	0	0	0	0	0	0	0	0	0	0.0	0.0	0.0	0.
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	v.v	v.v	V+1
5	MISC LD											,	0	1
	P HOTH20	0	0	0	0	0	0	0		0	0	0	0	0.
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.
£	MISC LD								٨		•	٨		
	P CHILL	Q	0	0	0	0	0	0		0	0.0	0.0	0.0	0.
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	v.
1	E01001L	2-STG CENTRIFUGAL CHILLER >550 TONS 0 0 0 0 0 213085 314496 235339 159344 0 0 0												
	ELEC	0	0	Û	0						0	0	0	922,25 788.
	PK	0.0	0.0	0.0	0.0	0.0	742.1	788.8	746.0	724.4	0.0	0.0	0.0	/06+
1	E05100			ING TOWE					12511	077/1		٨	٨	156,94
	ELEC	0		0			42142			27714	0	0	0	
	PK	0.0	0.0	0.0	0.0	0.0	78.0	78.0	78.0	78.0	0.0	0.0	0.0	78.
1	E05100			INS TOWE									٨	4 50
	WATER	0	0	0	0	0	987				0	0	0	4,20
	PK	0.0	0.0	0.0	0.0	0.0	3.1	3.3	3.1	3.1	0.0	0.0	0.0	3.
1	EB5001		CHIL	LED WATE	R PUMP -		TANT VOL							75.41
	ELEC	0	0	0	0	0	20160			17640	0	0	0	79,46
	PK	0.0	0.0	0.0	0.0	0.0	28.0	28.0	28.0	28.0	0.0	0.0	0.0	28.

Trans Air Conditioning Economics By: C.D.S. MARKETING

EQUIPMENT ENERGY CONSUMPTION - ALTERNATIVE 4 12 HOUR ICE BUILD, 6 HOUR CHILLER RUN

Ref	Equip					Mant	hly Cons	uention						
	Code	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Bot	Nev	Dec	Total
1	E05010		COND	ENSER WA	TER PUMP	-CV(HI6)	EFFIC.	Į.						
_	ELEC	0	0	0	0	0	8532	9816	8816	7110	0	()	0	33,275
	PK	0.0	0.0	0.0	0.0	0.0	15.8	15.8	15.8	15.8	0.0	0.0	0.0	15.8
1	EB5300		CONT	ROL PANE	L & INTE	RLOCKS								
	ELEC	0	0	0	0	0	720	744	744	630	0	0	0	2,838
	PK	0.0	0.0	0.0	0.0	0.0	1.0	1.0	1.0	1.0	0.0	0.0	0.0	1.0
1	E05013		WATE	R CIRCUL	ATING PU	MP - CDI	STANT VI	OLUME						
	ELEC	0	0	0	0	0	15212	15719	15719	11409	0	0	0	58,060
	PK	0.0	0.0	0.0	0.0	0.0	42.3	42.3	42.3	42.3	0.0	0.0	0.0	42.3

# ECO IH-5

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 2 8 HOUR ICE BUILD, 13 HOUR CHILLER RUN

	ELEC	DEMAND	
	On Peak	On Peak	WATER
Month	(kWh)	{k₩}	(1000 61)
Jan	0	0	0
Feb	0	0	0
March	0	0	0
April	0	0	0
Hay	0	0	0
June	358,977	892	942
July	453,487	913	1,359
Aug	379,911	877	1,011
Sept	297,877	774	678
Oct	0	0	0
Nov	0	0	0
Dec	0	0	0
Total	1,490,252	913	3,990

Building Energy Consumption = 17,701 (Btu/Sq Ft/Year) Source Energy Consumption = 53,109 (Btu/Sq Ft/Year)

Floor Area = 287,340 (Sq Ft)

EBUIPMENT ENERGY CONSUMPTION - ALTERNATIVE 2 8 HOUR ICE BUILD, 13 HOUR CHILLER RUN

	_					M	kk) n							
	Equip -	1	F - 1	N					Aus		Oct	Nev	Dec	Tota
u s	Code	Jan	Feb	Ber	Apr	Ħay	June	July	Aug	Sep	oc t	NUV	DEC	,013
0	LIGHTS													
	ELEC	0	0	0	0	0	98298	101575	101575	98298	0	0	0	399,74
	PK	0.0	0.0	0.0	0.0	0.0	250.0	250.0	250.0	250.0	0.0	0.0	0.0	250.
1	MISC LD													
	ELEC	0	0	0	0.0	0.0	0.0	0.0	0	()	0	Û	0	
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.
2	MISC LD													
	SAS	0	0	0	0	()	0	0	0	0	0	Ø	0	
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
3	MISC LD													
	DIL	0	0	0	0	0	0	0	0	0	0.0	0	()	
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
4	MISC LD													
	P STEAM	0	0	Ú	0	0	0	0	0	0	0	0	0	
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
5	MISC LD												4	
	P HOTH20	0	0	0	0	0	0		0	0	0	()	0	,
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	(
6	MISC LD												4	
	P CHILL	0	0	0	0	0	()	0	0	0	0	0	0	,
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	\$
1	E01001L			TE CENTR										700 1
	ELEC	0	0	0	0				196615		0	0	0	782,
	PK	0.0	0.0	0.0	0.0	0.0	589.6	619.0	589.6	571.6	0.0	0.0	0.0	61
1	E85100			ING TOWE										150
	ELEC	0	0	0	0			42728		31341	0	0	0	158,
	PK	0.0	0.0	0.0	0.0	0.0	65.6	65.6	65.6	65.6	0.0	0.0	0.0	5
1	E05100			ING TOWE										<del>9</del> 1
	WATER	0		0		0					Û	0	0	3,
	PK	0.0	0.0	0.0		0.0	3.1	3.2	3.1	2.6	0.0	0.0	0.0	
1	EB5001		CHIL	LED WATE	R PUMP -		TANT VOL							80
	ELEC	0	0	0	0	0	20160			18928	0	0	0	80,
	PK	0.0	0.0	0.0	0.0	0.0	28.0	28.0	28.0	28.0	0.0	0.0	0.0	2

Trane Air Conditioning Economics By: C.D.S. MARKETINS

EQUIPMENT ENERGY CONSUMPTION - ALTERNATIVE 2 8 HOUR ICE BUILD, 13 HOUR CHILLER RUN

Ref	Equip					Hont	hly Cons	umption						
	Code	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Total
1	E05010		COND	ENSER WA	TER PUMP	-CV(HIGH	EFFIC.)							
	ELEC	0	0	0	0	0	8505	8788	8788	7911	0	0	0	33,993
	PK	0.0	0.0	0.0	0.0	0.0	13.5	13.5	13.5	13.5	0.0	0.0.	0.0	13.5
1	E95300		CONT	ROL PANE	L & INTE	RLOCKS								
	ELEC	0	0	0	0	0	720	744	744	676	0	0	0	2,884
	PK	0.0	0.0	0.0	0.0	0.0	1.0	1.0	1.0	1.0	0.0	0.0	0.0	1.0
1	E05013		WATE	R CIRCUL	ATING PU	MP - CON	ISTANT VO	LUME						
	ELEC	0	0	0	0	0	8352	8630	8630	6821	0	0	0	32,433
	PK	0.0	0.0	0.0	0.0	0.0	34.8	34.8	34.8	34.8	0.0	0.0	0.0	34.8

# ECO IT-1

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 1 8 HOUR ICE BUILD, 16 HOUR CHILLER RUN

------ MONTHLY ENERGY CONSUMPTION -----

	ELEC	DEMAND	
	On Peak	On Peak	WATER
Month	(kWh)	(kW)	(1000 61)
Jan	()	0	0
Feb	0	0	0
March	0	0	0
April	0	0	0
May	0	0	0
June	323,900	648	994
July	419,084	859	1,391
Aug	344,432	647	1,073
Sept	258,791	637	701
Dct	0	0	0
Nov	0	0	0
Dec	0	0	. 0
Total	1,346,207	859	4,160

Source Energy Consumption = 47,975 (Btu/Sq Ft/Year)

Building Energy Consumption = 15,990 (Btu/Sq Ft/Year)

Floor Area = 287,340 (Sq Ft)

Trane Air Conditioning Economics By: C.D.S. MARKETING

EQUIPMENT ENERGY CONSUMPTION - ALTERNATIVE 1 B HOUR ICE BUILD, 16 HOUR CHILLER RUN

ef	Equip -					Mont	hly Cons	sumption						
	Code	Jan	Feb	Ħar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Total
0	LIGHTS								464775	22222	٨		٨	700 745
	ELEC	0	0	0	0	0		101575		98298	0	0,	0	399,745
	PK	0.0	0.0	0.0	0.0	0.0	250.0	250.0	250.0	250.0	0.0	0.0	0.0	250.0
1	MISC LD						6		٨	٨	^	0	0	4
	ELEC	0	0	0	()	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	υ.υ	0.0	0.0	0.0	0.0	0.
2	MISC LD						4	4	٨	٨	٨	0	0	
	GAS	0	0	0	0	0	0	0	0	0	()			0.
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.
3	MISC LD					^	^	٨	0	0	0	0	6	
	DIL	0	0	0	0	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	V.U	0.0	0.0	0.0	0.0	٧,
4	MISC LD				٨		r	٨	0	0	0	0	0	
	P STEAM	9	0	0	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	V.V	0.0	0.0	V.V	
5	MISC LD P HOTH20	٨	0	0	0	0	0	0	0	0	0	0	0	
	P HOSHZO PK	0 0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.
	FA	0.0	0.0	0.0	V.0	0.0	V.V	***	***	•••	•••			
ć	MISC LD P CHILL	0 -	. 0	0	0	0	0	0	0	()	0	0	0	
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0
1	E01001S		2-S	T6 CENTR	IFUGAL D	HILLER	(550 TD)	<del>I</del> S						
_	ELEC	0	0	0	0	0	21564	38101	23317	9250	0	0	0	92,2
	PK	0.0	0.0	0.0	0.0	0.0	127.0	297.2	196.8	99.5	0.0	0.0	0.0	297
1	E05100		COOL	INS TOWE	R FANS									
	ELEC	0	-0	0	0		7778			3259	0	0	0	27,1
	PK	0.0	0.0	0.0	0.0	0.0	32.4	32.4	32.4	32.4	0.0	0.0	0.0	32
i	E95100			ING TONE				<u>.</u>					٨	4
	WATER	0	0			0					0	0	0	
	PK	0.0	0.0	0.0	0.0	0.0	0.7	1.6	1.1	0.6	0.0	0.0	0.0	1
1	E05001		CHIL	LED WATE			TANT VOL			_				
	ELEC	0	0	0	0	0	0				0	0	0	,
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	(

EQUIPMENT ENERGY CONSUMPTION - ALTERNATIVE 1 8 HOUR ICE BUILD, 16 HOUR CHILLER RUN

Ref	Equip -					Honi	thly Con	sumption						
	Code	Jan	Feb	Mar	Apr				Aug		Oct	Nov	Dec	Total
1	E95010		COND	ENSER WA	TER PUMP	-CV(HIG	EFFIC.	}						
	ELEC	0	0	0	0	0	0	()	0	0	0	0.	0	0
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	E95300		CONTI	ROL PANEI	L & INTE	RLOCKS								
	ELEC	0	0	0	0	0	240	248	248	240	0	0	0	976
	PK	0.0	0.0	0.0	0.0	0.0	1.0	1.0	1.0	1.0	0.0	0.0	0.0	1.0
2	E01001S		2-S	TG CENTR	IFUGAL C									
	ELEC	0	0	0	0		172858			126004	0	0	0	726,824
	PK	0.0	0.0	0.0	0.0	0.0	388.1	402.1	382.0	371.5	0.0	0.0	0.0	402.1
2	E05100		COOL	ING TONE	R FANS									
	ELEC	0	0-	Q.	0	0	22604	28194	24913	21198	0	0	0	96,908
	PK	0.0	0.0	0.0	0.0	0.0	40.5	40.5	40.5	40.5	0.0	0.0	0.0	40.5
2	EB5100		C00L	ING TOWE	R FANS				,					
	WATER	0	0	0	0	0	881	1178	948	664	0	0	0	3,671
	PK	0.0	0.0	0.0	0.0	0.0	2.0	2.0	1.9	1.9	0.0	0.0	0.0	2.0
2	E05001		CHIL	LED WATE	R PUMP -	CONST	ANT VOLU	ME						
	ELEC	0	0	0	0	0	0	0	0	0	0	0	0	0
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	E95010		COND	ENSER WA	TER PUMP	-CV(HIG	H EFFIC.	}						
	ELEC	0	0	0	0	0	0	0	0	0	0	0	0	0
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	EB5300			ROL PANE										
	ELEC	0	0	0	0	0	558	696	615		0	0	0	2,411
	PK	0.0	0.0	0.0	0.0	0.0	1.0	1.0	1.0	1.0	0.0	0.0	0.0	1.0

# ECO IT-2

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 2 11 HOUR ICE BUILD, 13 HOUR CHILLER RUN

------ HONTHLY ENERGY CONSUMPTION ------

	ELEC	DEMAND	
	On Peak	On Peak	WATER
Month	(kWh)	(kW)	(1000 51)
Jan	0	0	0
Feb	0	0	0
Harch	0	0	0
April	0	0	0
May	0	0	0
June	328,168	606	992
July	426,614	830	1,402
Aug	350,686	631	1,085
Sept	256,216	596	691
Oct	0	0	0
Nov	0	0	. 0
_ Dec	0	0	0
Total	1,361,684	830	4,170

Building Energy Consumption = 15,174 (Rtu/Sq Ft/Year)
Source Energy Consumption = 48,527 (Rtu/Sq Ft/Year)

Floor Area = 287,340 (Sq Ft)

EQUIPMENT ENERGY CONSUMPTION - ALTERNATIVE 2 11 HOUR ICE BUILD, 13 HOUR CHILLER RUN

1=4	Equip					Monti	hly Cons	umption						
	Code	Jan	Feb	Har	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Total
0	LIGHTS								101575	88888	4	٨	0	399,745
	ELEC PK	0.0	0.0	0.0	0.0	0.0	98298 250.0	101575 250.0	101575 250.0	98298 250.0	0.0	0.0-	0.0	250.0
1	MISC LD							6	٥	0	0	0	0	0
	PK PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	MISC LD						۸	0	0	0	0	0	0	0
	BAS PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	MISC LD					٨	0	0	0	0	0	0	0	0
	DIL PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ą	MISC LD						۸	0	. 0	0	0	0	0	0
	P STEAM PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	MISC LD					4	^	0	0	0	0	0	0	0
	P HOTH20 PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0
6	MISC LD								٨	٨	۸	٥	0	(
	P CHILL PK	0.0	0.0	0.0	0.0	0.0	0.0			0.0	0.0	0.0	0.0	0.0
,	E01001S		2-5	STG CENTR	IFUGAL C	HILLER	(550 TO	NS						475 861
•	ELEC PK	0.0	0.0	0.0	0.0	0.0	35030 167.3	60854		16871 136.5	0.0	0.0	0.0	150,20 322.
1	EB5100		0001	LING TOWE	R FANS								٨	43,19
	ELEC PK	0.0	0.0	0.0	0.0	0.0				6296 36.5	0.0	0.0	0.0	36.
	1 EQ5100		CDO	LING TOW	R FANS			•						
•	WATER	0	0	0	0	0					0.0	0.0	0.0	78 1.
	PK	0.0	0.0	0.0	0.0	0.0			7 1.3	. v.o		V.V	V.V	•
	1 EB5001			LLED WAT			TANT VOL		0 0	. 0	0	ó	0	
	ELEC PK	0.0	0.0	0.0	0.0	0.0					0.0	0.0	0.0	0.

Trane Air Conditioning Economics By: C.D.S. MARKETINE

EQUIPMENT ENERGY CONSUMPTION - ALTERNATIVE 2 11 HOUR ICE BUILD, 13 HOUR CHILLER RUN

----- EBUIPMENT ENERGY CONSUMPTION----------- Monthly Consumption ------Ref Equip Total Nov Dec June July Ацо Sep Dot Nue Code Jan Feb Mar Apr May CONDENSER WATER PUMP-CV(HIGH EFFIC.) 1 E05010 0 0 0 0 0 0 0 ELEC 0 0 0 0 0 0 0.0 0.0 0.0 0.0 0.0 0.0 PK 0.0 0.0 0.0 0.0 0.0 0.0 0.0 1 EB5300 CONTROL PANEL & INTERLOCKS 341 300 0 1.312 341 0 0 330 ELEC 0 0 0 0 0 0.0 0.0 1.0 1.0 0.0 0.0 0.0 0.0 0.0 1.0 1.0 1.0 0.0 PK 2 E01001S 2-STB CENTRIFUGAL CHILLER (550 TONS 0 0 0 162701 225941 177462 117431 683,536 0 0 0 ELEC 0 0.0 0.0 349.3 361.9 343.8 334.3 0.0 0.0 361.9 0.0 0.0 PK 0.0 0.0 COOLING TOWER FANS 2 EB5100 81,447 0 19250 24791 20854 16553 0 0 0 ELEC Ð 0 0 0 0.0 36.5 36.5 36.5 0.0 0.0 36.5 36.5 PK 0.0 0.0 0.0 0.0 0.0 COOLING TOWER FANS 2 E05100 3,382 0 0 885 618 0 0 0 0 0 0 809 1070 WATER 1.8 0.0 0.0 1.8 1.7 0.0 1.8 1.8 0.0 0.0 0.0 PY 0.0 0.0 CHILLED WATER PUMP - CONSTANT VOLUME 2 E05001 0 0 0 -0 0 0 0 0 0 0 0 0 ELEC 0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 PK. 2 E05010 CONDENSER WATER PUMP-CV(HIGH EFFIC.) 0 0 0 0 0 ELEC 0 -0 0 0 0 0 0 0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 PK 0.0 0.0 2 E05300 CONTROL PANEL & INTERLOCKS 2,248 572 468 0 0 0 ELEC 0 0 0 0 528 680 0 0.0 0.0 1.0 1.0 1.0 0.0 0.0 PK 0.0 0.0 0.0 0.0 1.0 1.0

# ECO IT-3

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 3 8 HOUR ICE BUILD, 10 HOUR CHILLER RUN

	ELEC	DEMAND	
	On Peak	On Peak	WATER
Honth	(kWh)	(kW)	(1000 61)
Jan	0	0	0
Feb	()	0	0
March	0	0	0
April	0	0	0
May	0	0	0
June	336,084	864	962
July	435,802	1,118	1,394
Aug	366,197	1,047	1,067
Sept	288,333	883	729
Oct	0	0	0
Nov	0	0	. 0
Dec	0	. 0	0
Total	1,426,416	1,118	4,152

Building Energy Consumption = 16,943 (Btu/Sq Ft/Year)

Floor Area = 287,340 (Sq Ft)

Source Energy Consumption = 50,834 (Btu/Sq Ft/Year)

Trane Air Conditioning Economics By: C.D.S. MARKETING

EQUIPMENT ENERGY CONSUMPTION - ALTERNATIVE 3 B HOUR ICE BUILD, 10 HOUR CHILLER RUN

f	Equip					Mont	hly Cons	sumption						
	Code	Jan	Feb	Mar	Apr	Hay	June	July	Aug	Sep	Oct	Nov	Dec	Total
	LIGHTS													700 745
	ELEC	0	0	0	0	0	98298	101575		98298	0	0	0	399,745
	PK	0.0	0.0	0.0	0.0	0.0	250.0	250.0	250.0	250.0	0.0	0.0	0.0	250.0
1	MISC LD													
	ELEC	0	0	0	0	0	0	0	0	0	0	0	0	
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6
2	MISC LD													
	eas	0	0	0	0	0	0	0	0	0	0	0	0	
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.
3	MISC LD													
	DIL	0	Û	0	0	0	0	0	0	0	0	0	0	
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.
4	MISC LD												^	
	P STEAM	0	Q.	0	0	0	0	0	0	0	0	0	0	0.
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0,
5	MISC LD								٨	Û	0	0	0	
	P HOTH20	0	0	0	0	0	0	0		0.0	0.0	0.0	0.0	0.
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
6	HISC LD							۸	٨	0	0	0	0	
	P CHILL PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
	FRICAIR			T6 CENTR	TENEAL F	משונוני	/550 TO	uc.						
1	EB10015	٨		O CENTR	0	0	21564	38101	23317	9250	0	0	0	92,2
	ELEC PK	0.0	0.0	0.0	0.0	0.0	127.0	297.2		99.5	0.0	0.0	0.0	297
t	E05100		CUUI	ING TOWE	R FANS									
•	ELEC	0	0	0	0	0	7778	8037	8037	3259	0	0	0	27,1
	PK	0.0		0.0				32.4	32.4			0.0		32
1	E95100		COOL	ING TOWE	R FANS									
-	WATER	0	0	0	0	0	113	213			. 0	0	0	4
	PK	0.0	0.0		0.0	0.0		1.6	1.1	0.6	0.0	0.0	0.0	1
i	E95001		CHIL	LED WATE	R PUMP	- CONST	TANT VOL							
	ELEC	0	0	0	0	0	0	0			0	0	0	
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	

Trane Air Conditioning Economics By: C.D.S. MARKETING

EQUIPMENT EMERGY CONSUMPTION - ALTERNATIVE 3 B HOUR ICE BUILD, 10 HOUR CHILLER RUN

ef	Equip					Hon	thly Con	sumption						
lu <b>s</b>	Code	มือก	Feb	Har	Apr			July	Aug			Nov	Dec	Total
1	E05010		CONDI	ENSER WA	TER PUMP	-CV(HIG	H EFFIC.	)						
	ELEC	0	0	0	0	0	0	0	0	0	0	0	0	0
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	E05300		CONT	ROL PANE	L & INTE	RLDCKS								
	ELEC	0	0	0	0	0	240	248	248	240	0	0	0	976
	PK	0.0	0.0	0.0	0.0	0.0	1.0	1.0	1.0	1.0	0.0	0.0	0.0	1.0
2	E81001S		2-S	TE CENTR	IFUGAL C									
	ELEC	0	O.	0	0					147362	0	0	0	772,209
	PK	0.0	0.0	0.0	0.0	0.0	584.5	631.1	584.5	566.6	0.0	0.0	0.0	631.1
2	E05100		CODL	ING TOWE	R FANS									
	ELEC	0	0	0	0	0		35568	35043	29262	0	0	0	131,373
	PK	0.0	0.0	0.0	0.0	0.0	65.6	65.6	65.6	65.6	0.0	0.0	0.0	65.6
2	EB5100		COOL	INS TOWE	R FANS									
	WATER	0	0	0	0	0		1181	941		0	•	0	3,667
	PK	0.0	0.0	0.0	0.0	0.0	3.0	3.2	2.9	2.5	0.0	0.0	0.0	3.2
2	E05001		CHIL	LED WATE	R PUMP -	CONST	ANT VOLU							
	ELEC	0	0	0	0	0	0	0	0		0	0	0	(
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	E05010		COND	ENSER WA	TER PUMP	-CV(HIS		.}						
	ELEC	0	. 0	0	0	0	0	0	0	0	0	0	0	
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	E95300		CONT		L & INTE									
	ELEC	0	0	0	0	0	660	728	720		0	0	0	2,77
	PK	0.0	0.0	0.0	0.0	0.0	1.0	1.0	1.0	1.0	0.0	0.0	0.0	1.

# ECO IT-4

Trane Air Conditioning Economics By: C.D.S. MARKETINE

MONTHLY EMERGY CONSUMPTION - ALTERNATIVE 4 11 HOUR ICE BUILD, 7 HOUR CHILLER RUN

	ELEC	DEMAND	
	On Peak	On Peak	WATER
Honth	(kWh)	(kW)	(1000 Gl)
Jan	0	0	0
Feb	0	0	0
March	0	0	0
April	0	0	0
May	0	0	0
June	328,844	736	967
July	430,629	981	1,396
Aug	358,020	913	1,072
Sept	276,736	690	723
Oct	0	0	0
Nov	0	0	. 0
Dec	0	0	0
Total	1,394,229	981	4,159

Building Energy Consumption = 16,561 (Btu/Sq Ft/Year)
Source Energy Consumption = 49,687 (Btu/Sq Ft/Year)

Floor Area = 287,340 (Sq Ft)

Trane Air Conditioning Economics By: C.D.S. MARKETING

EQUIPMENT ENERGY CONSUMPTION - ALTERNATIVE 4 11 HOUR ICE BUILD, 7 HOUR CHILLER RUN

ef	Equip					Honi	hly Con	sumption						
	Code	Jan	Feb	Mar	Apr	May		July			Oct	Nov	Dec	Total
0	LIGHTS													707 711
	ELEC	0	0	0	0	0	98298	101575		98298	0	0.	0	399,745
	PK	0.0	0.0	0.0	0.0	0.0	250.0	250.0	250.0	250.0	0.0	0.0	0.0	250.0
1	MISC LD												٨	
	ELEC	0	0	0	0	0	0	0	0	0	0	0	0	
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.
2	MISC LD													
	BAS	0	0	0	0	0	0	0	0	0	0	0	0	
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.
3	MISC LD				,									
	DIL	0	0	0	0	0	0		0	0	0	0	0	
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.
4	MISC LD								,					
	P STEAM	0	0	0	()	0	0	0	0	0	0	0	0	
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
5	MISC LD												•	
	P HOTH20	0	0	0	0	0	0		0	0	0	0	0	0
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	v
6	MISC LD													
	P CHILL	0	0	0	0	0	0		0	0	0	0	0	
	PX	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
1	E01001S			TE CENTR								•		450.0
	ELEC	0	0	0	0	0	35030		37450	16871	0	0	0	150,2
	PK	0.0	0.0	0.0	0.0	0.0	167.3	322.6	223.4	136.5	0.0	0.0	0.0	322
1	E95100			ING TONE									٨	43,1
	ELEC	0			0			12432		6296	0	0	0	
	PK	0.0	0.0	0.0	0.0	0.0	36.5	36.5	36.5	36.5	0.0	0.0	0.0	38
1	E85100			INS TOWE									•	;
	WATER	0	0		0	0	184				0	0	0	
	PK	0.0	0.0	0.0	0.0	0.0	0.9	1.7	1.3	0.8	.0.0	0.0	0.0	
1	E95001			LED WATE			ANT VOL				_			
	ELEC	0	0	0	0	0	0			0	0	0	0	
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	

Trane Air Conditioning Economics By: C.D.S. MARKETINS

EQUIPMENT ENERGY CONSUMPTION - ALTERNATIVE 4
11 HOUR ICE BUILD, 7 HOUR CHILLER RUN

Ref	Equip -					Hon	thly Con	sumption						
Nua	Code	Jan	Feb	Ħar	Apr	May	June	July	Aug	Sep	Dct	Nov	Dec	Total
1	E05010		COND	ENSER WA	TER PUMP	-CV(HIG	H EFFIC.	)						
	ELEC	0	0	0	0	0	0		0	0	0	0	0	0
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	E05300		CONTI	ROL PANE	L & INTE	RLOCKS								
	ELEC	0	0	0	Û	0	330	341	341	300	0	0	0	1,312
	PK	0.0	0.0	0.0	0.0	0.0	1.0	1.0	1.0	1.0	0.0	0.0	0.0	1.0
2	E91001L		2-S	TE CENTR	IFUBAL C									
	ELEC	0	0	0	0				180589		0	0	0	702,437
	PK	0.0	0.0	0.0	0.0	0.0	473.0	500.4	474.6	459.2	0.0	0.0	0.0	500.4
2	E05100		COOL	INS TOWE	R FANS									
	ELEC	0	0	0	0	0	21957	26735	24956		0	0		94,736
	PK	0.0	0.0	0.0	0.0	0.0	50.8	50.8	50.8	50.8	0.0	0.0	0.0	50.8
2	E85100		COOL	INS TOWE	R FANS				•					
	WATER	0	0	0	0	0				651	0	0	0	3,371
	PK	0.0	0.0	0.0	0.0	0.0	2.4	2.5	2.4	2.4	0.0	0.0	0.0	2.5
2	E95001		CHIL	LED WATE	R PUMP -	CONST	ANT VOLL	IHE						
	ELEC	0	0	0	0	0	0	0	0	0	0	0	0	(
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	E95010		COND	ENSER WA	TER PUMP	-CV(HIE	SH EFFIC.	.)						
-	ELEC	0	. 0	0	0	0	0		0	0	0	0	0	(
-=	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6
2	E85300				L & INTE							_	_	pt + a.c.
	ELEL	0	0	0	0	0	612	712	677		0	0	0	2,600
	PK	0.0	0.0	0.0	0.0	0.0	1.0	1.0	1.0	1.0	0.0	0.0	0.0	1.0

# ECO IT-5

MONTHLY ENERGY CONSUMPTION - ALTERNATIVE 4 11 HOUR ICE BUILD, 10 HOUR CHILLER RUN

------ MONTHLY ENERGY CONSUMPTION -----

	ELEC	DEMAND	
	On Peak	On Peak	WATER
Honth	(kWh)	(k₩)	(1000 61)
Jan	0	0	0
Feb	0	Û	0
Harch	0	0	0
April	0	0	0
Hay	0	0	0
June	330,432	659	987
July	430,572	887	1,401
Aug	355,477	821	1,079
Sept	269,063	649	717
Oct	0	0	0
Nov	0	0	0
Dec	0	0	. 0
Total	1,385,543	887	4,184

Building Energy Consumption = 16,457 (Btu/Sq Ft/Year)
Source Energy Consumption = 49,377 (Btu/Sq Ft/Year)

Floor Area = 287,340 (Sq Ft)

Trane Air Conditioning Economics
By: C.D.S. MARKETING

EBUIPMENT ENERGY CONSUMPTION - ALTERNATIVE 4 11 HOUR ICE BUILD, 10 HOUR CHILLER RUN

s f	Equip -					Moni	thly Con	sumption						
	Code	Jan	Feb	Ħar	Apr	Hay	June	July		Sep	Oct	Nov	Dec	Tota
0	LIGHTS													
	ELEC	0	()	0	0	0	98298	101575		98298	0	0	6)	399,74
	PK	0.0	0.0	0.0	0.0	0.0	250.0	250.0	250.0	250.0	0.0	0.0	0.0	250.
1	MISC LD													
	ELEC	0	0	0	0	()	0	Û	0	0	0	0	0	
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.
2	MISC LD													
	BAS	0	0	0	0	0	0	0	0	0	0	0	0	
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.
3	MISC LD													
	DIL	0	0	0	0	0	0	0	Q	0	0	0	0	
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
Ą	MISC LD													
	P STEAM	0	0	0	()	0	0	0	0	0	0	0	0	
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
5	MISC LD													
	P HOTH20	0	0	()	()	0	()	0	0	0	0	0	0	
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
6	MISC LD													
	P CHILL	0 -	0	0	0	0	0	0	0	0	0	0	0	
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	(
1	E010015		2-5	TE CENTR	IFUGAL C	HILLER		S						
	ELEC	0	0	0	0	0	35030	60854	37450	16871	0	0	0	150,2
	PK	0.0	0.0	0.0	0.0	0.0	167.3	322.6	223.4	136.5	0.0	0.0	0.0	322
1	E95100			ING TOWE										
	ELEC	0	0	-	0	0		12432	12432	6296	0	0	0	43,1
	PK	0.0	0.0	0.0	0.0	0.0	36.5	36.5	36.5	36.5	0.0	0.0	0.0	38
1	EQ5100			ING TONE										_
	WATER	0	0	-	0	0	184	332		73	0	0	0	
	PK	0.0	0.0	0.0	0.0	0.0	0.9	1.7	1.3	0.8	0.0	0.0	0.0	1
1	E85001		CHIL	LED WATE	R PUMP -		ANT VOLU							
	ELEC	0	0	0	0	0	0	0		0	0	0	0	
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1

Trane Air Conditioning Economics By: C.D.S. MARKETING

EQUIPMENT ENERGY CONSUMPTION - ALTERNATIVE 4 11 HOUR ICE BUILD, 10 HOUR CHILLER RUN

0-4	Equip -					Mont	hly Cons	umption						
	Code	Jan	Feb	Mar	Apr	May	June	July			Oct	YOM	Dec	Total
1	E05010		CONDE	NSER WAT	ER PUMP-I	CV(HISH	EFFIC.							
•	ELEC	0	0	0	0	0	0	0	0	0	0	0	0	0
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	E05300		CONTR	OL PANEL	& INTER	LDCKS							0	1,312
-	ELEC	0	0	0	0	0	330	341	341	300	0	0	0	1.0
	PK	0.0	0.0	0.0	0.0	0.0	1.0	1.0	1.0	1.0	0.0	0.0	0.0	1.0
2	E01001S		2-5	IG CENTRI	FUGAL CH	IILLER	(550 TON	S				•	0	701,478
_	ELEC	0	0	0	0		163950		180253	128004	0	0	0.0	418.2
	PK	0.0	0.0	0.0	0.0	0.0	403.3	418.2	394.0	384.8	0.0	0.0	0.0	41012
2	E05100		COOL	ING TOWE	R FANS								٨	87,171
	ELEC	0	0	0	0	0		25404	22792	18753	0	0	0.0	42.1
	PK	0.0	0.0	0.0	0.0	0.0	42.1	42.1	42.1	42.1	0.0	0.0	0.0	72.5
2	E85100		COOL	ING TOWE	R FANS								0	3,39
_	WATER	0	0	0	0	0		1059	879	644	0	0	0.0	2.6
	PK	0.0	0.0	0.0	0.0	0.0	2.0	2.0	2.0	2.0	0.0	0.0	0.0	2.00
2	EB5001		CHIL	LED WATE	R PUMP -	CONS	TANT VOLU						0	
	ELEC	0	0	0	0	0	0	0			0	0	0.0	0.:
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	٧,
. ;	2 E05010		CON	DENSER WA	TER PUMP	-CV(HI						٨	0	
	ELEC	0	. 0	0	0	0					0	0.0	0.0	0.
	PK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	V.V	٧.
	2 E95300		CON	TROL PAN					,	245	٨	0	0	2,44
-	ELEC	0	0	0	0	9					0	0.0	0.0	1.
	PK	0.0	0.0	0.0	0.0	0.0	1.0	1.0	1.0	1.0	0.0	0.0	V + V	

#### APPENDIX G

### CONCEPTUAL COST ESTIMATES

# BASE CASE ESTIMATE CENTRIFUGAL CHILLER

Project Name:	COE FLW THERMAL STORAGE
Project Number:	930073-0017 ALTERNATIVE CC-1
Date:	August 02, 1995
Prepared By:	MELISSA RUSSO
OHECCE	PAGE 1
Department:	MECHANICAL-HVAC

Base Labor Rate:	
City Multiplier:	0%
Effective Labor Rate:	\$50.00

### **ESTIMATE OF CONSTRUCTION COST**

ITEM			MATE	RIAL		1.	ABOR		MATERIAL/ LABOR
# DESCRIPTION	QTY.	UNIT	COST/UNIT	TOTAL	RS/UNI	OST/UNI	TOTAL HRS	TOTAL COST	TOTAL
CHILLER		TONS		\$162,000.00	1.00	\$80.00		\$72,000.00	\$234,000.00
CLG TWR (900 TONS)	900	EA	\$40.00	\$36,000.00	1.00	\$6.25		\$5,625.00	\$41,625.00
						(s. Música)		A Section 1	\$0.00
VENTILATION SYSTEM	1	LS							\$1,000.00
REFRIGERATION MONIT	1	LS					1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	7 A. HESS	\$4,500.00
						Karto di	1 1.14.9	ij tan jilan	\$0.00
CHILLED WTR SYSTEM						The Section	a Hagti		\$0.00
PUMPS 1440 GPM	1	EA	\$3,803.00	\$3,803.00	18.00	\$900.00		\$900.00	\$4,703.00
						Germani	is with		EDW 1 NESS
8" BUTTERFLY VALVES	6	EA	\$345.00	\$2,070.00	5.33	\$266.50	ar ditti	\$1,599.00	\$3,669.00
THERMOMETERS	2	EA	\$33.00	\$66.00	0.25	\$12.50	A Congress	\$25.00	\$91.00
PRESSURE GAGES	2	EA	\$16.50	\$33.00	0.25	\$12.50		\$25.00	\$58.00
RELIEF VALVES	1	ĒA	\$79.00	\$79.00	0.33	\$16.65		\$16.65	\$95.65
1" BALL VALVES	8	EA	\$12.20	\$97.60	0.42	\$21.05		\$168.40	\$266.00
GAGE COCKS	5	EA	\$12.20	\$61.00	0.42	\$21.05	Weller	\$105.25	\$166.25
8" AIR SEPARATOR	1	EA	\$2,525.00	\$2,525.00	8.00	\$400.00		\$400.00	\$2,925.00
FLEXIBLE CONNECTOR	2	EA	\$232.00	\$464.00	4.00	\$200.00		\$400.00	\$864.00
CHEMICAL POT FEEDER	1	LS							\$2,000.00
8" PIPING	400	LF	\$42.50	\$17,000.00	1.26	\$63.15		\$25,260.00	\$42,260.00
2" PIPING	50	LF	\$5.30	\$265.00	0.12	\$5.90		\$295.00	\$560.00
3/4" PIPING	50	LF	\$2.08	\$104.00	0.11	\$5.40		\$270.00	\$374.00
8" INSULATION	400	LF	\$2.23	\$892.00	0.16	\$8.00		\$3,200.00	\$4,092.00
2" INSULATION	50	LF	\$0.80	\$40.00	0.08	\$4.00	All Alexand	\$200.00	\$240.00
3/4" INSULATION	50	LF	\$0.28	\$14.00	0.07	\$3.50	10 - 12 - 14 - 14 - 15 - 15 - 15 - 15 - 15 - 15	\$175.00	\$189.00
150 GAL EXP TANK	1	EA	\$845.00	\$845.00	4.00	\$200.00		\$200.00	\$1,045.00
FILL VALVE ASSEMBLY	1	EA	\$113.00	\$113.00	0.42	\$21.05		\$21.05	\$134.05
MANUAL AIR VENT	1	EA	\$35.00	\$35.00	0.67	\$33.35		\$33.35	\$68.35
1" STRAINER	1	EA	\$13.75	\$13.75	0.47	\$23.55		\$23.55	\$37.30
TRIPLE DUTY VALVE	1	EA	\$2,208.00	\$2,208.00	8.00	\$400.00		\$400.00	\$2,608.00
SUCTION DIFFUSER	1	EA	\$2,093.00	\$2,093.00	8.00	\$400.00	14 T 4 B 11	\$400.00	\$2,493.00

Subtotals:

\$230,821.35

\$111,742.25 \$350,063.60

Sales Tax:

\$0.00

 Overhead:
 10%
 \$35,006.36

 Profit:
 10%
 \$38,507.00

Subtotal:

\$423,576.96

Bond: Contingen \$0.00 15% \$63,536.54

**Grand Total:** 

\$487,113.50

Project Name:	COE FLW THERMAL STORAGE
Project Number:	930073-0017 ALTERNATIVE CC-1
Date:	April 10, 1995
Prepared By:	MELISSA RUSSO
Sheet:	PAGE 2
Department:	MECHANICAL-HVAC

Base Labor Rate:	
City Multiplier:	0%
Effective Labor Rate:	\$50.00

## **ESTIMATE OF CONSTRUCTION COST**

	ITEM			MATER	IAL		LABO	OR		MATERIAL/ LABOR
#	DESCRIPTION	QTY.	UNIT	COST/UNIT	TOTAL	HRS/UNIT	COST/UNIT	TOTAL HRS	TOTAL COST	TOTAL
Ë					egyfor negyf			_44~(8~%)		
	CONDENSER WTR SYS				The Confidence			gyat Adolla		Paratral in
	PUMPS 2160 GPM	1	EA	\$5,900.00	\$5,900.00	24.00	\$1,200.00	24.00	\$1,200.00	\$7,100.00
	GRISWOLD SEPARATOR	1	EA	\$5,850.00	\$5,850.00	8.00	\$400.00	8.00	\$400.00	\$6,250.00
	10" BUTTERFLY VALVE	6	EA	\$425.00	\$2,550.00	6.00	\$300.00	36.00	\$1,800.00	\$4,350.00
	PRESSURE GAGES	3	EA	\$16.50	\$49.50	0.25	\$12.50	0.75	\$37.50	\$87.00
	BALANCING VALVES	1	EA	\$56.00	\$56.00	0.44	\$22.20	0.44	\$22.20	\$78.20
	AUTO PURGE VALVE	1	EA	\$1,050.00	\$1,050.00	0.73	\$36.35	0.73	\$36.35	\$1,086.35
	1"BALL VALVES	6	EA	\$12.20	\$73.20	0.42	\$21.05	2.53	\$126.30	\$199.50
	FLEXIBLE CONNECTOR	3	EA	\$340.00	\$1,020.00	4.50	\$225.00	13.50	\$675.00	\$1,695.00
	1-1/2" STRAINERS	2	EA	\$47.00	\$94.00	0.57	\$28.55	1.14	\$57.10	\$151.10
_	THERMOMETERS	2	EA	\$33.00	\$66.00	0.25	\$12.50	0.50	\$25.00	\$91.00
	GAGE COCKS	7	EA	\$12.20	\$85.40	0.42	\$21.05	2.95	\$147.35	\$232.75
_	10" PIPING	400	LF	\$73.00	\$29,200.00	1.50	\$75.00	600.00	\$30,000.00	\$59,200.00
<del>                                     </del>	3" PIPING	50	LF	\$6.60	\$330.00	0.37	\$18.60	18.60	\$930.00	\$1,260.00
$\vdash$	2" VENT PIPING	10	LF	\$4.12	\$41.20	0.26	\$13.10	2.62	\$131.00	\$172.20
$\vdash$	I" DRAIN PIPING	15	LF	\$2.18	\$32.70	0.15	\$7.55	2.27	\$113.25	\$145.95
	1-1/2" BALL VALVES	3	EA	\$18.05	\$54.15	0.62	\$30.75	1.85	\$92.25	\$146.40
$\vdash$	CHEM FEED PUMP/TAN	1	LS		\$0.00		\$0.00	0.00	\$0.00	\$2,000.00
-	SOLENOID VALVE	1	EA	\$410.00	\$410.00	0.75	\$37.50	0.75	\$37.50	\$447.50
$\vdash$	3" BUTTERFLY VALVES	2	EA	\$185.00	\$370.00	2.00	\$100.00	4.00	\$200.00	\$570.00
	TRIPLE DUTY VALVE	1	EA	\$2,208.00	\$2,208.00	8.00	\$400.00	8.00	\$400.00	\$2,608.00
	SUCTION DIFFUSER	1	EA	\$1,053.00	\$1,053.00	6.00	\$300.00	6.00	\$300.00	\$1,353.00
$\vdash$	PROJ MAN/MISC COSTS	1	LS				mining Hara			\$34,400.00
							Life of the Mark	Appli to the		
_	SEISMIC	1	LS		10000		arion star			\$7,500.00
					100		Property Contract			
	CONTROLS	1	LS		13.81 14.164					\$60,000.00
					ri pariju ki saliju		i i i jaja ja kantonala			1 11 11 11
	BALANCING	1	LS		1.4					\$4,000.00
-								see early t	n e e e e e e	1

Subtotals:

\$50,493.15

734.62 \$36,730.80 \$195,123.95

Sales Tax:

\$0.00

 Overhead:
 10%
 \$19,512.40

 Profit:
 10%
 \$19,512.40

Subtotal:

\$234,148.74

Bond: Contingency: \$0.00 15% \$35,122.31

**Grand Total:** 

\$269,271.05

Project Name:	Ft. Leonardwood Chiller Study - Alt. CC-1					
Project Number:	930073-0017					
Date:	August 17, 1995					
Prepared By:	S. Benway					
Sheet:	1 of 2					
Department:	Electrical					

Base Labor Rate:	\$28.50
City Multiplier (Labor):	114%
Effective Labor Rate:	\$32.55

102%
֡

## ESTIMATE OF CONSTRUCTION COST

ITEM			MATERIAL		LABOR .				MATERIAL/ LABOR	
#	DESCRIPTION	QTY.	UNIT	COST/UNIT	TOTAL	RS/UNI	COST/UNIT	TOTAL HRS	TOTAL COST	TOTAL
	Chiller Replacement				\$0.00		\$0.00	0.00	\$0.00	\$0.00
1	Demolition	1	LOT	n/a	\$0.00	86.64	\$2,820.00	86.64	\$2,820.00	\$2,820.00
2	Shielded, 5kv, #3/0, cu. w	180	L.F.	\$2.75	\$504.00	0.04	\$1.43	7.90	\$257.00	\$761.00
3	Cable Termination	12	EA	\$98.23	\$1,200.00	1.23	\$40.00	14.75	\$480.00	\$1,680.01
4	Grounding	1	LOT	n/a	\$0.00	6.15	\$200.00	6.15	\$200.00	\$200.00
5	2 1/2" Rigid Conduit	40	L.F.	\$5.60	\$228.00	0.18	\$5.70	7.01	\$228.00	\$456.00
6	2 1/2" Rigid Connector	6	EA	\$7.86	\$48.00	1.23	\$40.00	7.37	\$240.00	\$288.00
7	2 1/2" Conduit Hanger	4	EA	\$9.82	\$40.00	0.61	\$20.00	2.46	\$80.00	\$120.00
8	2 1/2" Flex Conduit	5	L.F.	\$2.16	\$11.00	0.23	\$7.60	1.17	\$38.00	\$49.00
9	2 1/2" Flex Connector	2	EA	\$23.58	\$48.00	0.35	\$11.50	0.71	\$23.00	\$71.00
10	5kv Fuse	3	EA	\$294.70	\$900.00	4.82	\$157.00	14.47	\$471.00	\$1,371.00
11	2" Elbow	2	EA	\$22.60	\$46.00	0.88	\$28.50	1.75	\$57.00	\$103.00
12	Connection to Equipment	1	LOT	n/a	\$0.00	7.99	\$260.00	7.99	\$260.00	\$260.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
	Chilled Water Pump-40hp				\$0.00		\$0.00	0.00	\$0.00	\$0.00
13	#1/0 thwn cu. conductor	150	L.F.	\$1.14	\$173.40	0.02	\$0.65	3.00	\$97.64	\$271.04
14	1 1/4" EMT conduit	40	L.F.	\$1.21	\$49.27	0.08	\$2.60	3.20	\$104.15	\$153.42
15	150amp fuse	3	EA	\$29.00	\$88.57	0.20	\$6.51	0.60	\$19.53	\$108.09
16	Connection to Equipment	1	EA	\$20.00	\$20.36	4.00	\$130.19	4.00	\$130.19	\$150.55
17	Combo. Starter/Disc.	1	EA	\$1,360.51	\$1,385.00	10.60	\$345.00	10.60	\$345.00	\$1,730.00
18	1 1/4" Flex Conduit	5	L.F.	\$1.07	\$5.45	0.11	\$3.71	0.57	\$18.55	\$24.00
19	1 1/4" Flex Connector	2	EA	\$6.38	\$12.98	0.20	\$6.51	0.40	\$13.02	\$26.00
20	150amp switch in Panel	1	EA	\$918.38	\$934.91	2.00	\$65.09	2.00	\$65.09	\$1,000.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
	Surge Tank Pump-50hp				\$0.00		\$0.00	0.00	\$0.00	\$0.00
21	#1 thwn cu. conductor	150	L.F.	\$1.60	\$244.32	0.12	\$3.75	17.27	\$561.99	\$806.31
22	1 1/2" EMT conduit	40	L.F.	\$1.90	\$77.37	0.18	\$5.86	7.20	\$234.34	\$311.71
23	175amp fuse	3	EA	\$21.00	\$64.13	0.60	\$19.53	1.80	\$58.58	\$122.72
24	Connection to Equipment	I	EA	\$160.50	\$163.39	12.00	\$390.56	12.00	\$390.56	\$553.95
25	Combo. Starter/Disc.	1	EA	\$1,400.00	\$1,425.20	11.00	\$358.02	11.00	\$358.02	\$1,783.22
26	1 1/2" Flex Conduit	5	L.F.	\$1.80	\$9.16	0.54	\$17.58	2.70	\$87.88	\$97.04
27	1 1/2" Flex Connector	2	EA	\$9.50	\$19.34	0.42	\$13.67	0.84	\$27.34	\$46.68
28	200amp switch in Panel	1	ÉA	\$1,000.00	\$1,018.00	8.00	\$260.38	8.00	\$260.38	\$1,278.38
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
Г					\$0.00		\$0.00	0.00	\$0.00	\$0.00
Г					\$0.00		\$0.00	0.00	\$0.00	\$0.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00

Project Name:	Ft. Leonardwood Chiller Study					
Project Number:	930073-0017					
Date:	August 17, 1995					
Prepared By:	S. Benway					
Sheet:	2 of 2					
Department:	Electrical					

Base Labor Rate:	\$28.50
City Multiplier (Labor):	114%
Effective Labor Rate:	\$32.55

City Multiplier	(Material):	102%

## **ESTIMATE OF CONSTRUCTION COST**

ITEM			MATERIAL		LABOR ·				MATERIAL/ LABOR	
#	DESCRIPTION	QTY.	UNIT	COST/UNIT	TOTAL	RS/UNI	COST/UNIT	TOTAL HRS	TOTAL COST	TOTAL
	Cond. Water Pump-25hp				\$0.00		\$0.00	0.00	\$0.00	\$0.00
37	#4 thwn cu. conductor	180	L.F.	\$0.39	\$71.46	0.02	\$0.65	3.60	\$117.17	\$188.63
38	1 1/4" EMT conduit	50	L.F.	\$1.21	\$61.59	0.08	\$2.60	4.00	\$130.19	\$191.78
39	90amp fuse	3	EA	\$10.15	\$31.00	0.20	\$6.51	0.60	\$19.53	\$50.53
40	Connection to Equipment	1	EA	\$30.00	\$30.54	4.09	\$133.17	4.09	\$133.17	\$163.71
41	Combo. Starter/Disc.	1	EA	\$1,356.58	\$1,381.00	10.60	\$345.00	10.60	\$345.00	\$1,726.00
42	1 1/4" Flex Conduit	5	L.F.	\$1.07	\$5.45	0.11	\$3.58	0.55	\$17.90	\$23.35
43	1 1/4" Flex Connector	2	EA	\$6.38	\$12.99	0.20	\$6.51	0.40	\$13.02	\$26.01
44	100amp switch in Panel	1	EA	\$918.38	\$934.91	2.00	\$65.09	2.00	\$65.09	\$1,000.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
		1			\$0.00		\$0.00	0.00	\$0.00	\$0.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
		$\vdash$			\$0.00		\$0.00	0.00	\$0.00	\$0.00
$\vdash$					\$0.00		\$0.00	0.00	\$0.00	\$0.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
		1			\$0.00		\$0.00	0.00	\$0.00	\$0.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
					\$0.00	1	\$0.00	0.00	\$0.00	\$0.00
					\$0.00		\$0.00	0,00	\$0.00	\$0.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00

Subtotals:

\$11,244.79

269.37 \$8,767.32 \$20,012.10

Sales Tax:

0% \$0.00

Overhead: Profit: 10% \$2,001.21 10% \$2,201.33

Subtotal:

\$24,214.65

Bond: Contingency: 0% \$0.00 10% \$2,421.46

**Grand Total:** 

\$26,636.11

# ICE HARVESTER SYSTEM COST ESTIMATES

	COE FLW THERMAL STORAGE
Project Number:	930073-0017 ALTERNATIVE IH-1
Date:	April 05, 1995
Prepared By:	MELISSA RUSSO
	PAGE 1
Department:	MECHANICAL-HVAC

Base Labor Rate:	
City Multiplier:	0%
Effective Labor Rate:	\$50.00

# ESTIMATE OF CONSTRUCTION COST

ITEM			MATERIAL		LABOR .				MATERIAL/ LABOR
# DESCRIPTION	QTY.	UNIT	COST/UNIT	TOTAL	HRS/UNIT	COST/UNIT	TOTAL HRS	TOTAL COST	TOTAL
ICE HARVESTOR	485	TONS	\$1,250.00	\$606,250.00	3.50	\$175.00	1697.50	\$84,875.00	\$691,125.00
CLG TWR-630 TONS	1	EA	\$17,000.00	\$17,000.00	100.00	\$5,000.00	100.00	\$5,000.00	\$22,000.00
HOISTING	1	LS		\$0.00		\$0.00	0.00	\$0.00	\$8,000.00
TANK	1	EA		\$0.00		\$0.00	0.00	\$0.00	\$49,725.00
PLATE HEAT EXCHNGR	1	EA	\$14,328.00	\$14,328.00	80.00	\$4,000.00	80.00	\$4,000.00	\$18,328.00
				\$0.00		\$0.00	0.00	\$0.00	\$0.00
CHILLED WTR SYSTEM				\$0.00		\$0.00	0.00	\$0.00	\$0.00
PUMPS 1440 GPM	1	EA	\$3,803.00	\$3,803.00	18.00	\$900.00	18.00	\$900.00	\$4,703.00
				\$0.00		\$0.00	0.00	\$0.00	\$0.00
8" BUTTERFLY VALVES	6	EA	\$345.00	\$2,070.00	5.33	\$266.50	31.98	\$1,599.00	\$3,669.00
THERMOMETERS	2	EA	\$33.00	\$66.00	0.25	\$12.50	0.50	\$25.00	\$91.00
PRESSURE GAGES	2	EA	\$16.50	\$33.00	0.25	\$12.50	0.50	\$25.00	\$58.00
RELIEF VALVES	1	EA	\$79.00	\$79.00	0.33	\$16.65	0.33	\$16.65	\$95.65
1" BALL VALVES	8	EA	\$12.20	\$97.60	0.42	\$21.05	3.37	\$168.40	\$266.00
GAGE COCKS	5	EA	\$12.20	\$61.00	0.42	\$21.05	2.11	\$105.25	\$166.25
8" AIR SEPARATOR	1	EA	\$2,525.00	\$2,525.00	8.00	\$400.00	8.00	\$400.00	\$2,925.00
FLEXIBLE CONNECTOR	2	EA	\$232.00	\$464.00	4.00	\$200.00	8.00	\$400.00	\$864.00
CHEMICAL POT FEEDER	1	ls		\$0.00		\$0.00	0.00	\$0.00	\$2,000.00
8" PIPING	400	LF	\$42.50	\$17,000.00	1.26	\$63.15	505.20	\$25,260.00	\$42,260.00
2" PIPING	100	LF	\$5.30	\$530.00	0.12	\$5.90	11.80	\$590.00	\$1,120.00
3/4" PIPING	50	LF	\$2.08	\$104.00	0.11	\$5.40	5.40	\$270.00	\$374.00
8" INSULATION	400	LF	\$2.23	\$892.00	0.16	\$8.00	64.00	\$3,200.00	\$4,092.00
2" INSULATION	100	LF	\$0.80	\$80.00	0.08	\$4.00	8.00	\$400.00	\$480.00
3/4" INSULATION	50	LF	\$0.28	\$14.00	0.07	\$3.50	3.50	\$175.00	\$189.00
				\$0.00		\$0.00	0.00	\$0.00	\$0.00
150 GAL EXP TANK	1	EA	\$845.00	\$845.00	4.00	\$200.00	4.00	\$200.00	\$1,045.00
FILL VALVE ASSEMBLY	1	EA	\$113.00	\$113.00	0.42	\$21.05	0.42	\$21.05	\$134.05
MANUAL AIR VENT	1	EA	\$35.00	\$35.00	0.67	\$33.35	0.67	\$33.35	\$68.35
1" STRAINER	1	EA	\$13.75	\$13.75	0.47	\$23.55	0.47	\$23.55	\$37.30
TRIPLE DUTY VALVE	1	EA	\$1,338.00	\$1,338.00	6.00	\$300.00	6.00	\$300.00	\$1,638.00
SUCTION DIFFUSER	1	EA	\$1,205.00	\$1,205.00	5.00	\$250.00	5.00	\$250.00	\$1,455.00

Subtotals: \$668,9

\$668,946.35

2564.75 \$128,237.25 \$856,908.60

Sales Tax: \$0.00

 Overhead:
 10%
 \$85,690.86

 Profit:
 10%
 \$94,259.95

Subtotal:

\$1,036,859.41

Bond: \$0.00 Contingency: 15% \$155,528.91

**Grand Total:** 

\$1,192,388.32

Project Name:	COE FLW THERMAL STORAGE
Project Number:	930073-0017 ALTERNATIVE IH-1
Date:	April 05, 1995
Prepared By:	MELISSA RUSSO
Sheet:	PAGE 2
Department:	MECHANICAL-HVAC

Base Labor Rate:	
City Multiplier:	0%
Effective Labor Rate:	\$50.00

### **ESTIMATE OF CONSTRUCTION COST**

ITEM				MATER	IAL	LABOR			MATERIAL/ LABOR	
#	DESCRIPTION	QTY.	UNIT	COST/UNIT	TOTAL	HRS/UNIT	COST/UNIT	TOTAL HRS	TOTAL COST	TOTAL
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
$\vdash$	CONDENSER WTR SYS	:			\$0.00		\$0.00	0.00	\$0.00	\$0.00
	PUMPS 1510 GPM	1	EA	\$2,693.00	\$2,693.00	18.00	\$900.00	18.00	\$900.00	\$3,593.00
	GRISWOLD SEPARATOR	1	EA	\$4,750.00	\$4,750.00	8.00	\$400.00	8.00	\$400.00	\$5,150.00
<u> </u>	10" BUTTERFLY VALVE	6	EA	\$425.00	\$2,550.00	6.00	\$300.00	36.00	\$1,800.00	\$4,350.00
	PRESSURE GAGES	3	EA	\$16.50	\$49.50	0.25	\$12.50	0.75	\$37.50	\$87.00
	BALANCING VALVES	1	EA	\$56.00	\$56.00	0.44	\$22.20	0.44	\$22.20	\$78.20
	AUTO PURGE VALVE	1	EA	\$1,050.00	\$1,050.00	0.73	\$36.35	0.73	\$36.35	\$1,086.35
	1"BALL VALVES	6	EA	\$12.20	\$73.20	0.42	\$21.05	2.53	\$126.30	\$199.50
	FLEXIBLE CONNECTOR	3	EA	\$340.00	\$1,020.00	4.50	\$225.00	13.50	\$675.00	\$1,695.00
	1-1/2" STRAINERS	2	EA	\$47.00	\$94.00	0.57	\$28.55	1.14	\$57.10	\$151.10
	THERMOMETERS	2	EA	\$33.00	\$66.00	0.25	\$12.50	0.50	\$25.00	\$91.00
	GAGE COCKS	7	EA	\$12.20	\$85.40	0.42	\$21.05	2.95	\$147.35	\$232.75
	10" PIPING	400	LF	\$73.00	\$29,200.00	1.50	\$75.00	600.00	\$30,000.00	\$59,200.00
	3" PIPING	50	LF	\$6.60	\$330.00	0.37	\$18.60	18.60	\$930.00	\$1,260.00
	2" VENT PIPING	10	LF	\$4.12	\$41.20	0.26	\$13.10	2.62	\$131.00	\$172.20
	1" DRAIN PIPING	15	LF	\$2.18	\$32.70	0.15	\$7.55	2.27	\$113.25	\$145.95
	1-1/2" BALL VALVES	3	EA	\$18.05	\$54.15	0.62	\$30.75	1.85	\$92.25	\$146.40
	CHEM FEED PUMP/TANK	1	LS		\$0.00		\$0.00	0.00	\$0.00	\$2,000.00
	SOLENOID VALVE	1	EA	\$410.00	\$410.00	0.75	\$37.50	0.75	\$37.50	\$447.50
	3" BUTTERFLY VALVES	2	EA	\$185.00	\$370.00	2.00	\$100.00	4.00	\$200.00	\$570.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
	TRIPLE DUTY VALVE	1	EA	\$1,338.00	\$1,338.00	8.00	\$400.00	8.00	\$400.00	\$1,738.00
	SUCTION DIFFUSER	1	EA	\$1,205.00	\$1,205.00	6.00	\$300.00	6.00	\$300.00	\$1,505.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00

Subtotals: \$4

\$45,468.15

728.62 \$36,430.80 \$83,898.95

Sales Tax: \$0.00

 Overhead:
 10%
 \$8,389.90

 Profit:
 10%
 \$8,389.90

Subtotal:

\$100,678.74

Bond: \$0.00 Contingency: 15% \$15,101.81

**Grand Total:** 

\$115,780.55

E I O CCC LIMITOR	COE FLW THERMAL STORAGE
Project Number:	930073-0017 ALTERNATIVE IH-1
Date:	April 05, 1995
Prepared By:	MELISSA RUSSO
Sheet:	PAGE 3
Department:	MECHANICAL-HVAC

Base Labor Rate:	
City Multiplier:	0%
Effective Labor Rate:	\$50.00

## **ESTIMATE OF CONSTRUCTION COST**

ITEM	MATER	IAL	LABOR			MATERIAL/ LABOR			
# DESCRIPTION	QTY.	UNIT	COST/UNIT	TOTAL	HRS/UNIT	COST/UNIT	TOTAL HRS	TOTAL COST	TOTAL
				\$0.00		\$0.00	0.00	\$0.00	\$0.00
TANK PUMPING SYSTEM				\$0.00		\$0.00	0.00	\$0.00	\$0.00
VERT TURBINE PUMPS				\$0.00		\$0.00	0.00	\$0.00	\$0.00
2330 GPM	1	EA	\$9,740.00	\$9,740.00	60.00	\$3,000.00	60.00	\$3,000.00	\$12,740.00
10" BUTTERFLY VALVES	6	EA	\$425.00	\$2,550.00	6.00	\$300.00	36.00	\$1,800.00	\$4,350.00
THERMOMETERS	2	EA	\$33.00	\$66.00	0.25	\$12.50	0.50	\$25.00	\$91.00
PRESSURE GAGES	2	EA	\$16.50	\$33.00	0.25	\$12.50	0.50	\$25.00	\$58.00
RELIEF VALVES	1	EA	\$79.00	\$79.00	0.33	\$16.50	0.33	\$16.50	\$95.50
1" BALL VALVES	8	EA	\$12.20	\$97.60	0.42	\$21.05	3.37	\$168.40	\$266.00
GAGE COCKS	5	EA	\$12.20	\$61.00	0.42	\$21.05	2.11	\$105.25	\$166.25
FLEXIBLE CONNECTORS	1	EA	\$340.00	\$340.00	4.50	\$225.00	4.50	\$225.00	\$565.00
FLEXIBLE CONNECTORS	1	EA	\$52.00	\$52.00	0.50	\$25.00	0.50	\$25.00	\$77.00
2-WAY CONTROL VALVE	1	EA	\$365.00	\$365.00	0.75	\$37.50	0.75	\$37.50	\$402.50
				\$0.00		\$0.00	0.00	\$0.00	\$0.00
				\$0.00		\$0.00	0.00	\$0.00	\$0.00
10" PIPING	150	LF	\$73.00	\$10,950.00		\$0.00	0.00	\$0.00	\$10,950.00
				\$0.00		\$0.00	0.00	\$0.00	\$0.00
				\$0.00		\$0.00	0.00	\$0.00	\$0.00
10" INSULATION	150	LF	\$2.60	\$390.00	0.18	\$8.90	26.70	\$1,335.00	\$1,725.00
				\$0.00		\$0.00	0.00	\$0.00	\$0.00
				\$0.00		\$0.00	0.00	\$0.00	\$0.00
				\$0.00		\$0.00	0.00	\$0.00	\$0.00
PROJ. MAN. / MISC COSTS	1	LS		\$0.00		\$0.00	0.00	\$0.00	\$24,000.00
				\$0.00		\$0.00	0.00	\$0.00	\$0.00
SEISMIC	1	LS		\$0.00		\$0.00	0.00	\$0.00	\$10,000.00
				\$0.00		\$0.00	0.00	\$0.00	\$0.00
CONTROLS	1	LS		\$0.00		\$0.00	0.00	\$0.00	\$90,000.00
				\$0.00		\$0.00	0.00	\$0.00	\$0.00
BALANCING	1	LS		\$0.00		\$0.00	0.00	\$0.00	\$4,000.00
				\$0.00		\$0.00	0.00	\$0.00	\$0.00
				\$0.00		\$0.00	0.00	\$0.00	\$0.00

Subtotals: \$24,723.60 135.25 \$6,762.65 \$159,486.25

 Sales Tax:
 \$0.00
 Overhead:
 10%
 \$15,948.63

 Profit:
 10%
 \$15,948.63

Subtotal: \$191,383.50

Bond: \$0.00 Contingency: 15% \$28,707.53

**Grand Total:** \$220,091.03

Project Name:	Ft. Leonardwood Chiller Study - Alt. IH-1						
Project Number:	930073-0017						
Date:	August 17, 1995						
Prepared By:	S. Benway						
Sheet:	1 of 2						
Department:	Electrical						

Base Labor Rate:	\$28.50
City Multiplier (Labor):	114%
Effective Labor Rate:	\$32.55

102%

## ESTIMATE OF CONSTRUCTION COST

ITEM				MATERIAL LABOR				MATERIAL/ LABOR		
#	DESCRIPTION	QTY.	UNIT	COST/UNIT	TOTAL	RS/UNI	COST/UNIT	TOTAL HRS	TOTAL COST	TOTAL
	Chiller Replacement				\$0.00		\$0.00	0.00	\$0.00	\$0.00
	Demolition	1	LOT	n/a	\$0.00	86.64	\$2,820.00	86.64	\$2,820.00	\$2,820.00
	Shielded, 5kv, #4, cu. wir	180	L.F.	\$1.00	\$183.90	0.04	\$1.30	7.20	\$234.34	\$418.24
-	Cable Termination	12	EA	\$60.00	\$732.96	0.93	\$30.11	11.10	\$361.27	\$1,094.23
	Grounding	1	EA	\$200.00	\$203.60	1.85	\$60.05	1.85	\$60.05	\$263.65
5	1 1/2" emt Conduit	40	L.F.	\$1.43	\$58.23	0.09	\$2.90	3.56	\$115.87	\$174.10
6	1 1/2" emt Connector	6	EA.	\$0.61	\$3.73	0.07	\$2.18	0.40	\$13.08	\$16.81
7	1 1/2" Conduit Hanger	4	EA	\$1.25	\$5.09	0.05	\$1.72	0.21	\$6.90	\$11.99
8	1 1/2" Flex Conduit	5	L.F.	\$0.31	\$1.58	0.04	\$1.30	0.20	\$6.51	\$8.09
9	1 1/2" Flex Connector	2	EA	\$1.00	\$2.04	0.10	\$3.25	0.20	\$6.51	\$8.55
10	5kv Fuse	3	EA	\$240.00	\$732.96	0.40	\$13.02	1.20	\$39.06	\$772.02
11	Connection to Equipment	1	EA	\$40.00	\$40.72	8.00	\$260.38	8.00	\$260.38	\$301.10
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
	Cooling Tower Fan-40hp				\$0.00		\$0.00	0.00	\$0.00	\$0.00
	#1/0 thwn cu. conductor	150	L.F.	\$1.14	\$173.40	0.02	\$0.65	3.00	\$97.64	\$271.04
13	1 1/4" EMT conduit	40	L.F.	\$1.21	\$49.27	0.08	\$2.60	3.20	\$104.15	\$153.42
14	150amp fuse	3	EA	\$29.00	\$88.57	0.20	\$6.51	0.60	\$19.53	\$108.09
	Connection to Equipment	1	EA	\$20.00	\$20.36	4.00	\$130.19	4.00	\$130.19	\$150.55
16	Combo. Starter/Disc.	1	EA	\$1,360.51	\$1,385.00	10.60	\$345.00	10.60	\$345.00	\$1,730.00
17	1 1/4" Flex Conduit	5	L.F.	\$1.07	\$5.45	0.11	\$3.71	0.57	\$18.55	\$24.00
18	1 1/4" Flex Connector	2	EA	\$6.38	\$12.98	0.20	\$6.51	0.40	\$13.02	\$26.00
19	150amp switch in Panel	1	EA	\$918.38	\$934.91	2.00	\$65.09	2.00	\$65.09	\$1,000.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
	Chilled Water Pump-40hp				\$0.00		\$0.00	0.00	\$0.00	\$0.00
20	#1/0 thwn cu. conductor	150	L.F.	\$1.14	\$173.40	0.02	\$0.65	3.00	\$97.64	\$271.04
21	1 1/4" EMT conduit	40	L.F.	\$1.21	\$49.27	0.08	\$2.60	3.20	\$104.15	\$153.42
22	150amp fuse	3	EA	\$29.00	\$88.57	0.20	\$6.51	0.60	\$19.53	\$108.09
23	Connection to Equipment	1	EA	\$20.00	\$20.36	4.00	\$130.19	4.00	\$130.19	\$150.55
24	Combo. Starter/Disc.	1	EA	\$1,360.51	\$1,385.00	10.60	\$345.00	10.60	\$345.00	\$1,730.00
25	1 1/4" Flex Conduit	5	L.F.	\$1.07	\$5.45	0.11	\$3.71	0.57	\$18.55	\$24.00
26	1 1/4" Flex Connector	2	EA	\$6.38	\$12.98	0.20	\$6.51	0.40	\$13.02	\$26.00
27	150amp switch in Panel	1	EA	\$918.38	\$934.91	2.00	\$65.09	2.00	\$65.09	\$1,000.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
	Surge Tank Pump-30hp				\$0.00		\$0.00	0.00	\$0.00	\$0.00
	#2 thwn cu. conductor	150	L.F.	\$0.55	\$83.83	0.02	\$0.65	3.00	\$97.64	\$181.47
	1 1/4" EMT conduit	40	L.F.	\$1.21	\$49.27	0.08	\$2.60	3.20	\$104.15	\$153.42
30	120amp fuse	3	EA	\$29.00	\$88.57	0.20	\$6.51	0.60	\$19.53	\$108.09
31	Connection to Equipment	1	EA	\$20.00	\$20.36	4.00	\$130.19	4.00	\$130.19	\$150.55
	Combo. Starter/Disc.	1	EA	\$1,356.58	\$1,381.00	10.60	\$345.00	10.60	\$345.00	\$1,726.00
	1 1/4" Flex Conduit	5	L.F.	\$1.07	\$5.45	0.11	\$3.71	0.57	\$18.55	\$24.00
34	1 1/4" Flex Connector	2	EA	\$6.38	\$12.98	0.20	\$6.51	0.40	\$13.02	\$26.00
35	100amp switch in Panel	1	EA	\$918.38	\$934.91	2.00	\$65.09	2.00	\$65.09	\$1,000.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00

Project Name:	Ft. Leonardwood Chiller Study					
Project Number:	930073-0017					
Date:	August 17, 1995					
Prepared By:	S. Benway					
Sheet:	2 of 2					
Department:	Electrical					

Base Labor Rate:	\$28.50
City Multiplier (Labor):	114%
Effective Labor Rate:	\$32.55

City Multiplier (Material):	102%

## **ESTIMATE OF CONSTRUCTION COST**

ITEM		MATERIAL		LABOR .				MATERIAL/ LABOR		
#	DESCRIPTION	QTY.	UNIT	COST/UNIT	TOTAL	RS/UNI	COST/UNIT	TOTAL HRS	TOTAL COST	TOTAL
	Cond. Water Pump-20hp				\$0.00		\$0.00	0.00	\$0.00	\$0.00
36	#3 thwn cu. conductor	150	L.F.	\$0.55	\$83.83	0.02	\$0.65	3.00	\$97.64	\$181.47
37	1 1/4" EMT conduit	40	L.F.	\$1.21	\$49.27	0.08	\$2.60	3.20	\$104.15	\$153.42
38	80amp fuse	3	EA	\$10.15	\$31.00	0.20	\$6.51	0.60	\$19.53	\$50.53
39	Connection to Equipment	1	EA	\$20.00	\$20.36	4.00	\$130.19	4.00	\$130.19	\$150.55
40	Combo. Starter/Disc.	1	EA	\$852.65	\$868.00	7.01	\$228.00	7.01	\$228.00	\$1,096.00
41	1 1/4" Flex Conduit	5	L.F.	\$1.05	\$5.34	0.11	\$3.71	0.57	\$18.55	\$23.90
42	1 1/4" Flex Connector	2	EA	\$6.25	\$12.73	0.20	\$6.51	0.40	\$13.02	\$25.74
43	100amp switch in Panel	1	EA	\$525.45	\$534.91	2.00	\$65.09	2.00	\$65.09	\$600.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
		1			\$0.00		\$0.00	0.00	\$0.00	\$0.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00

Subtotals:

\$11,486.46

214.45

\$6,979.65 \$18,466.10

Sales Tax:

0% \$0.00

Overhead: Profit:

10% \$1,846.61 10% \$2,031.27

Subtotal:

\$22,343.98

Bond: Contingency:

0% \$0.00 10% \$2,234.40

**Grand Total:** 

\$24,578.38

Project Name:	COE FLW THERMAL STORAGE
Project Number:	930073-0017 ALTERNATIVE IH-2
Date:	April 05, 1995
Prepared By:	MELISSA RUSSO
Sheet:	PAGE 1
Department:	MECHANICAL-HVAC

Base Labor Rate:			
City Multiplier:	0%		
Effective Labor Rate:	\$50.00		

## **ESTIMATE OF CONSTRUCTION COST**

ITEM			MATERIAL		LABOR				MATERIAL/ LABOR
# DESCRIPTION	QTY.		COST/UNIT					TOTAL COST	TOTAL
ICE HARVESTOR	885	TONS	\$1,250.00	\$1,106,250.00	3.50	\$175.00	3097.50	\$154,875.00	\$1,261,125.00
CLG TWR (1150 TONS)	1	EA	\$21,000.00	\$21,000.00	120.00	\$6,000.00	120.00	\$6,000.00	\$27,000.00
HOISTING	1	LS		\$0.00		\$0.00	0.00	\$0.00	\$8,000.00
TANK	1	EA		\$0.00		\$0.00	0.00	\$0.00	\$97,825.00
PLATE HEAT EXCHR	1	EA	#######	\$51,974.00	120.00		120.00	\$6,000.00	\$57,974.00
				\$0.00		\$0.00	0.00	\$0.00	\$0.00
CHILLED WTR SYSTEM				\$0.00		\$0.00	0.00	\$0.00	\$0.00
PUMPS 1440 GPM	1	EA	\$3,803.00	\$3,803.00	18.00	\$900.00	18.00	\$900.00	\$4,703.00
				\$0.00		\$0.00	0.00	\$0.00	\$0.00
8" BUTTERFLY VALVES	6	EA	\$345.00	\$2,070.00	5.33	\$266.50	31.98	\$1,599.00	\$3,669.00
THERMOMETERS	2	EA	\$33.00	\$66.00	0.25	\$12.50	0.50	\$25.00	\$91.00
PRESSURE GAGES	2	EA	\$16.50	\$33.00	0.25	\$12.50	0.50	\$25.00	\$58.00
RELIEF VALVES	1	EA	\$79.00	\$79.00	0.33	\$16.65	0.33	\$16.65	\$95.65
1" BALL VALVES	8	EA	\$12.20	\$97.60	0.42	\$21.05	3.37	\$168.40	\$266.00
GAGE COCKS	5	EA	\$12.20	\$61.00	0.42	\$21.05	2.11	\$105.25	\$166.25
8" AIR SEPARATOR	1	EA	\$2,525.00	\$2,525.00	8.00	\$400.00	8.00	\$400.00	\$2,925.00
FLEXIBLE CONNECTOR	2	EA	\$232.00	\$464.00	4.00	\$200.00	8.00	\$400.00	\$864.00
CHEMICAL POT FEEDER	1	LS		\$0.00		\$0.00	0.00	\$0.00	\$2,000.00
8" PIPING	400	LF	\$42.50	\$17,000.00	1.26	\$63.15	505.20	\$25,260.00	\$42,260.00
2" PIPING	100	LF	\$5.30	\$530.00	0.12	\$5.90	11.80	\$590.00	\$1,120.00
3/4" PIPING	50	LF	\$2.08	\$104.00	0.11	\$5.40	5.40	\$270.00	\$374.00
8" INSULATION	400	LF	\$2.23	\$892.00	0.16	\$8.00	64.00	\$3,200.00	\$4,092.00
2" INSULATION	100	LF	\$0.80	\$80.00	0.08	\$4.00	8.00	\$400.00	\$480.00
3/4" INSULATION	50	LF	\$0.28	\$14.00	0.07	\$3.50	3.50	\$175.00	\$189.00
				\$0.00		\$0.00	0.00	\$0.00	\$0.00
150 GAL EXP TANK	1	EA	\$845.00	\$845.00	4.00	\$200.00	4.00	\$200.00	\$1,045.00
FILL VALVE ASSEMBLY	1	EA	\$113.00	\$113.00	0.42	\$21.05	0.42	\$21.05	\$134.05
MANUAL AIR VENT	1	EA	\$35.00	\$35.00	0.67	\$33.35	0.67	\$33.35	\$68.35
1" STRAINER	1	EA	\$13.75	\$13.75	0.47	\$23.55	0.47	\$23.55	\$37.30
TRIPLE DUTY VALVE	1	EA	\$1,338.00	\$1,338.00	8.00	\$400.00	8.00	\$400.00	\$1,738.00
SUCTION DIFFUSER	1	EA	\$1,205.00	\$1,205.00	6.00	\$300.00	6.00	\$300.00	\$1,505.00

Subtotals: \$

\$1,210,592.35

4027.75 \$201,387.25 \$1,519,804.60

Sales Tax: \$0.00

 Overhead:
 10%
 \$151,980.46

 Profit:
 10%
 \$167,178.51

Subtotal:

\$1,838,963.57

Bond: \$0.00 Contingenc 15% \$275,844.53

**Grand Total:** 

\$2,114,808.10

Project Name:	COE FLW THERMAL STORAGE
Project Number:	930073-0017 ALTERNATIVE IH-2
Date:	April 05, 1995
Prepared By:	MELISSA RUSSO
Sheet:	PAGE 2
Department:	MECHANICAL-HVAC

Base Labor Rate:	
City Multiplier:	0%
Effective Labor Rate:	\$50.00

# **ESTIMATE OF CONSTRUCTION COST**

ITEM			MATERIAL		LABOR				MATERIAL/ LABOR	
#	DESCRIPTION	QTY.	UNIT	COST/UNIT	TOTAL	HRS/UNIT	COST/UNIT	TOTAL HRS	TOTAL COST	TOTAL
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
	CONDENSER WTR SYS				\$0.00		\$0.00	0.00	\$0.00	\$0.00
	PUMPS 2760 GPM	l	EA	\$2,693.00	\$2,693.00	24.00	\$1,200.00	24.00	\$1,200.00	\$3,893.00
	GRISWOLD SEPARATOR	1	EA	\$5,850.00	\$5,850.00	8.00	\$400.00	8.00	\$400.00	\$6,250.00
	10" BUTTERFLY VALVES	6	EA	\$425.00	\$2,550.00	6.00	\$300.00	36.00	\$1,800.00	\$4,350.00
	PRESSURE GAGES	3	EA	\$16.50	\$49.50	0.25	\$12.50	0.75	\$37.50	\$87.00
	BALANCING VALVES	1	EA	\$56.00	\$56.00	0.44	\$22.20	0.44	\$22.20	\$78.20
	AUTO PURGE VALVE	1	EA	\$1,050.00	\$1,050.00	0.73	\$36.35	0.73	\$36.35	\$1,086.35
	1"BALL VALVES	6	EA	\$12.20	\$73.20	0.42	\$21.05	2.53	\$126.30	\$199.50
	FLEXIBLE CONNECTOR	3	EA	\$340.00	\$1,020.00	4.50	\$225.00	13.50	\$675.00	\$1,695.00
	1-1/2" STRAINERS	2	EA	\$47.00	\$94.00	0.57	\$28.55	1.14	\$57.10	\$151.10
	THERMOMETERS	2	EA	\$33.00	\$66.00	0.25	\$12.50	0.50	\$25.00	\$91.00
	GAGE COCKS	7	EA	\$12.20	\$85.40	0.42	\$21.05	2.95	\$147.35	\$232.75
	10" PIPING	400	LF	\$73.00	\$29,200.00		\$75.00	600.00	\$30,000.00	\$59,200.00
	3" PIPING	50	LF	\$6.60	\$330.00	0.37	\$18.60	18.60	\$930.00	\$1,260.00
	2" VENT PIPING	10	LF	\$4.12	\$41.20	0.26	\$13.10	2.62	\$131.00	\$172.20
	1" DRAIN PIPING	15	LF	\$2.18	\$32.70	0.15	\$7.55	2.27	\$113.25	\$145.95
	1-1/2" BALL VALVES	3	EA	\$18.05	\$54.15	0.62	\$30.75	1.85	\$92.25	\$146.40
	CHEM FEED PUMP/TANK	1	LS		\$0.00		\$0.00	0.00	\$0.00	\$2,000.00
	SOLENOID VALVE	1	EA	\$410.00	\$410.00	0.75	\$37.50	0.75	\$37.50	\$447.50
	3" BUTTERFLY VALVES	2	EA	\$185.00	\$370.00	2.00	\$100.00	4.00	\$200.00	\$570.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
	TRIPLE DUTY VALVE	1	EA	\$1,338.00	\$1,338.00	6.00	\$300.00	6.00	\$300.00	\$1,638.00
	SUCTION DIFFUSER	1	EA	\$1,205.00	\$1,205.00	5.00	\$250.00	5.00	\$250.00	\$1,455.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
-					\$0.00		\$0.00	0.00	\$0.00	\$0.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
<b> </b>					\$0.00		\$0.00	0.00	\$0.00	\$0.00
$\vdash$					\$0.00		\$0.00	0.00	\$0.00	\$0.00
$\vdash$					\$0.00		\$0.00	0.00	\$0.00	\$0.00

Subtotals: \$46,568.15 731.62 \$36,580.80 \$85,148.95

Sales Tax: \$0.00 Overhead: 10% \$8,514.90
Profit: 10% \$8,514.90

Profit: 10% \$8,514.90

Subtotal: \$102,178.74

Bond: \$0.00 Contingency: 15% \$15,326.81

Grand Total: \$117,505.55

Project Name:	COE FLW THERMAL STORAGE
Project Number:	930073-0017 ALTERNATIVE IH-2
Date:	April 05, 1995
Prepared By:	MELISSA RUSSO
Sheet:	PAGE 3
Department:	MECHANICAL-HVAC

Base Labor Rate:	
City Multiplier:	0%
Effective Labor Rate:	\$50.00

# ESTIMATE OF CONSTRUCTION COST

ITEM		MATERIAL			MATERIAL/ LABOR				
# DESCRIPTION	QTY.	UNIT	COST/UNIT	TOTAL	HRS/UNIT	COST/UNIT	TOTAL HRS	TOTAL COST	TOTAL
				\$0.00		\$0.00	0.00	\$0.00	\$0.00
TANK PUMPING SYSTEM				\$0.00		\$0.00	0.00	\$0.00	\$0.00
VERT TURBINE PUMPS				\$0.00		\$0.00	0.00	\$0.00	\$0.00
4250 GPM	1	EA	\$13,835.00	\$13,835.00	60.00	\$3,000.00	60.00	\$3,000.00	\$16,835.00
12" BUTTERFLY VALVES	6	EA	\$595.00	\$3,570.00	8.00	\$400.00	48.00	\$2,400.00	\$5,970.00
THERMOMETERS	2	EA	\$33.00	\$66.00	0.25	\$12.50	0.50	\$25.00	\$91.00
PRESSURE GAGES	2	EA	\$16.50	\$33.00	0.25	\$12.50	0.50	\$25.00	\$58.00
RELIEF VALVES	1	EA	\$79.00	\$79.00	0.33	\$16.50	0.33	\$16.50	\$95.50
1" BALL VALVES	8	EA	\$12.20	\$97.60	0.42	\$21.05	3.37	\$168.40	\$266.00
GAGE COCKS	5	EA	\$12.20	\$61.00	0.42	\$21.05	2.11	\$105.25	\$166.25
FLEXIBLE CONNECTORS	1	EA	\$340.00	\$340.00	4.50	\$225.00	4.50	\$225.00	\$565.00
FLEXIBLE CONNECTOR	1	EA	\$52.00	\$52.00	0.50	\$25.00	0.50	\$25.00	\$77.00
2-WAY CONTROL VALVE	1	EA	\$365.00	\$365.00	0.75	\$37.50	0.75	\$37.50	\$402.50
				\$0.00		\$0.00	0.00	\$0.00	\$0.00
12" PIPING	200	LF	\$94.00	\$18,800.00	1.71	\$85.70	342.80	\$17,140.00	\$35,940.00
10" PIPING	200	LF	\$73.00	\$14,600.00	1.50	\$75.00	300.00	\$15,000.00	\$29,600.00
				\$0.00		\$0.00	0.00	\$0.00	\$0.00
12" INSULATION	200	LF	\$2.96	\$592.00	0.20	\$10.00	40.00	\$2,000.00	\$2,592.00
10" INSULATION	200	LF	\$2.60	\$520.00	0.18	\$8.90	35.60	\$1,780.00	\$2,300.00
				\$0.00		\$0.00	0.00	\$0.00	\$0.00
				\$0.00		\$0.00	0.00	\$0.00	\$0.00
				\$0.00		\$0.00	0.00	\$0.00	\$0.00
PROJ MAN/MISC COSTS	1	LS		\$0.00		\$0.00	0.00	\$0.00	\$39,900.00
				\$0.00		\$0.00	0.00	\$0.00	\$0.00
SIESMIC	1	LS		\$0.00		\$0.00	0.00	\$0.00	\$10,000.00
				\$0.00		\$0.00	0.00	\$0.00	\$0.00
CONTROLS	1	LS		\$0.00		\$0.00	0.00	\$0.00	\$146,000.00
				\$0.00		\$0.00	0.00	\$0.00	\$0.00
BALANCING	1	LS		\$0.00		\$0.00	0.00	\$0.00	\$4,000.00
				\$0.00		\$0.00	0.00	\$0.00	\$0.00
				\$0.00		\$0.00	0.00	\$0.00	\$0.00

Subtotals: \$5

\$53,010.60

838.95 \$41,947.65 \$294,858.25

Sales Tax: \$0.00

 Overhead:
 10%
 \$29,485.83

 Profit:
 10%
 \$29,485.83

Subtotal:

\$353,829.90

Bond: \$0.00 Contingency: 15% \$53,074.49

**Grand Total:** 

\$406,904.39

Project Name:	Ft. Leonardwood Chiller Study - Alt. IH-2
Project Number:	930073-0017
Date:	August 17, 1995
Prepared By:	S. Benway
Sheet:	1 of 2
Department:	Electrical

Base Labor Rate:	\$28.50
City Multiplier (Labor):	114%
Effective Labor Rate:	\$32.55

City Multiplier (Material):	102%

# ESTIMATE OF CONSTRUCTION COST

	ITEM				RIAL		MATERIAL/ LABOR			
#	DESCRIPTION	QTY.	UNIT	COST/UNIT	TOTAL	RS/UNI	COST/UNIT	TOTAL HRS	TOTAL COST	TOTAL
	Chiller Replacement				\$0.00		\$0.00	0.00	\$0.00	\$0.00
1	Demolition	1	LOT	n/a	\$0.00	86.64	\$2,820.00	86.64	\$2,820.00	\$2,820.00
2	Shielded, 5kv, #3/0, cu. w	180	L.F.	\$2.75	\$504.00	0.04	\$1.43	7.90	\$257.00	\$761.00
3	Cable Termination	12	EA	\$98.23	\$1,200.00	1.23	\$40.00	14.75	\$480.00	\$1,680.01
	Grounding	1	LOT	n/a	\$0.00	6.15	\$200.00	6.15	\$200.00	\$200.00
	2 1/2" Rigid Conduit	40	L.F.	\$5.60	\$228.00	0.18	\$5.70	7.01	\$228.00	\$456.00
6	2 1/2" Rigid Connector	6	EA	\$7.86	\$48.00	1.23	\$40.00	7.37	\$240.00	\$288.00
7	2 1/2" Conduit Hanger	4	EA	\$9.82	\$40.00	0.61	\$20.00	2.46	\$80.00	\$120.00
8	2 1/2" Flex Conduit	5	L.F.	\$2.16	\$11.00	0.23	\$7.60	1.17	\$38.00	\$49.00
9	2 1/2" Flex Connector	2	EA	\$23.58	\$48.00	0.35	\$11.50	0.71	\$23.00	\$71.00
10	5kv Fuse	3	EA	\$294.70	\$900.00	4.82	\$157.00	14.47	\$471.00	\$1,371.00
11	2" Elbow	2	EA	\$22.60	\$46.00	0.88	\$28.50	1.75	\$57.00	\$103.00
12	Connection to Equipment	1	LOT	n/a	\$0.00	7.99	\$260.00	7.99	\$260.00	\$260.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
	Chilled Water Pump-40hp				\$0.00		\$0.00	0.00	\$0.00	\$0.00
13	#1/0 thwn cu. conductor	150	L.F.	\$1.14	\$173.40	0.02	\$0.65	3.00	\$97.64	\$271.04
14	1 1/4" EMT conduit	40	L.F.	\$1.21	\$49.27	0.08	\$2.60	3.20	\$104.15	\$153.42
15	150amp fuse	3	EA	\$29.00	\$88.57	0.20	\$6.51	0.60	\$19.53	\$108.09
16	Connection to Equipment	1	EA	\$20.00	\$20.36	4.00	\$130.19	4.00	\$130.19	\$150.55
17	Combo. Starter/Disc.	1	EA	\$1,360.51	\$1,385.00	10.60	\$345.00	10.60	\$345.00	\$1,730.00
18	1 1/4" Flex Conduit	5	L.F.	\$1.07	\$5.45	0.11	\$3.71	0.57	\$18.55	\$24.00
19	1 1/4" Flex Connector	2	EA	\$6.38	\$12.98	0.20	\$6.51	0.40	\$13.02	\$26.00
20	150amp switch in Panel	1	EA	\$918.38	\$934.91	2.00	\$65.09	2.00	\$65.09	\$1,000.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
	Cooling Tower Fan-30hp				\$0.00		\$0.00	0.00	\$0.00	\$0.00
21	#2 thwn cu. conductor	150	L.F.	\$0.55	\$83.83	0.02	\$0.65	3.00	\$97.64	\$181.47
22	1 1/4" EMT conduit	40	L.F.	\$1.21	\$49.27	0.08	\$2.60	3.20	\$104.15	\$153.42
23	120amp fuse	3	EA	\$29.00	\$88.57	0.20	\$6.51	0.60	\$19.53	\$108.09
24	Connection to Equipment	1	EA	\$20.00	\$20.36	4.00	\$130.19	4.00	\$130.19	\$150.55
25		1	EA		\$1,381.00	10.60	\$345.00	10.60	\$345.00	\$1,726.00
26	1 1/4" Flex Conduit	5	L.F.	\$1.07	\$5.45	0.11	\$3.71	0.57	\$18.55	\$24.00
27		2	EA	\$6.38	\$12.98	0.20	\$6.51	0.40	\$13.02	\$26.00
28	100amp switch in Panel	1	EA	\$918.38	\$934.91	2.00	\$65.09	2.00	\$65.09	\$1,000.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
	Cooling Tower Fan-30hp				\$0.00	L	\$0.00	0.00	\$0.00	\$0.00
	#2 thwn cu. conductor	150	L.F.	\$0.55	\$83.83	0.02	\$0.65	3.00	\$97.64	\$181.47
	1 1/4" EMT conduit	40	L.F.	\$1.21	\$49.27	0.08	\$2.60	3.20	\$104.15	\$153.42
	120amp fuse	3	EA	\$29.00	\$88.57	0.20	\$6.51	0.60	\$19.53	\$108.09
	Connection to Equipment	1	EA	\$20.00	\$20.36	4.00	\$130.19	4.00	\$130.19	\$150.55
	Combo. Starter/Disc.	1	EA	\$1,356.58	\$1,381.00	10.60	\$345.00	10.60	\$345.00	\$1,726.00
	1 1/4" Flex Conduit	5	L.F.	\$1.07	\$5.45	0.11	\$3.71	0.57	\$18.55	\$24.00
	1 1/4" Flex Connector	2	EA	\$6.38	\$12.98	0.20	\$6.51	0.40	\$13.02	\$26.00
36	100amp switch in Panel	1	EA	\$918.38	\$934.91	2.00	\$65.09	2.00	\$65.09	\$1,000.00

Project Name:	Ft. Leonardwood Chiller Study
Project Number:	930073-0017
Date:	August 17, 1995
Prepared By:	S. Benway
Sheet:	2 of 2
Department:	Electrical

Base Labor Rate:	\$28.50
City Multiplier (Labor):	114%
Effective Labor Rate:	\$32.55

City Multiplier	(Material):	102%

# ESTIMATE OF CONSTRUCTION COST

ITEM				MATERIAL		LABOR ·				MATERIAL/ LABOR
#	# DESCRIPTION QTY. UNIT		UNIT	COST/UNIT TOTAL		RS/UNI	COST/UNIT	TOTAL HRS	TOTAL COST	TOTAL
	Cond. Water Pump-20hp				\$0.00		\$0.00	0.00	\$0.00	\$0.00
37	#3 thwn cu. conductor	150	L.F.	\$0.55	\$83.83	0.02	\$0.65	3.00	\$97.64	\$181.47
38	I 1/4" EMT conduit	40	L.F.	\$1.21	\$49.27	0.08	\$2.60	3.20	\$104.15	\$153.42
39	80amp fuse	3	EA	\$10.15	\$31.00	0.20	\$6.51	0.60	\$19.53	\$50.53
	Connection to Equipment	1	EA	\$20.00	\$20.36	4.00	\$130.19	4.00	\$130.19	\$150.55
41	Combo. Starter/Disc.	1	EA	\$852.65	\$868.00	7.01	\$228.00	7.01	\$228.00	\$1,096.00
42	1 1/4" Flex Conduit	5	L.F.	\$1.05	\$5.34	0.11	\$3.71	0.57	\$18.55	\$23.90
43	1 1/4" Flex Connector	2	EA	\$6.25	\$12.73	0.20	\$6.51	0.40	\$13.02	\$25.74
	100amp switch in Panel	1	EA	\$525.45	\$534.91	2.00	\$65.09	2.00	\$65.09	\$600.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
	Cond. Water Pump-20hp				\$0.00		\$0.00	0.00	\$0.00	\$0.00
45	#3 thwn cu. conductor	150	L.F.	\$0.55	\$83.83	0.02	\$0.65	3.00	\$97.64	\$181.47
46	1 1/4" EMT conduit	40	L.F.	\$1.21	\$49.27	0.08	\$2.60	3.20	\$104.15	\$153.42
47	80amp fuse	3	EA	\$10.15	\$31.00	0.20	\$6.51	0.60	\$19.53	\$50.53
	Connection to Equipment	1	EA	\$20.00	\$20.36	4.00	\$130.19	4.00	\$130.19	\$150.55
49		1	EA	\$852.65	\$868.00	7.01	\$228.00	7.01	\$228.00	\$1,096.00
50	1 1/4" Flex Conduit	5	L.F.	\$1.05	\$5.34	0.11	\$3.71	0.57	\$18.55	\$23.90
51	1 1/4" Flex Connector	2	EA	\$6.25	\$12.73	0.20	\$6.51	0.40	\$13.02	\$25.74
52	100amp switch in Panel	1	EA	\$525.45	\$534.91	2.00	\$65.09	2.00	\$65.09	\$600.00
	•				\$0.00		\$0.00	0.00	\$0.00	\$0.00
	Surge Tank Pump-50hp				\$0.00		\$0.00	0.00	\$0.00	\$0.00
53	#1 thwn cu. conductor	150	L.F.	\$1.60	\$244.32	0.12	\$3.75	17.27	\$561.99	\$806.31
54		40	L.F.	\$1.90	\$77.37	0.18	\$5.86	7.20	\$234.34	\$311.71
55	175amp fuse	3	EA	\$21.00	\$64.13	0.60	\$19.53	1.80	\$58.58	\$122.72
56		1	EA	\$160.50	\$163.39	12.00	\$390.56	12.00	\$390.56	\$553.95
57	Combo. Starter/Disc.	1	EA	\$1,400.00	\$1,425.20	11.00	\$358.02	11.00	\$358.02	\$1,783.22
58	1 1/2" Flex Conduit	5	L.F.	\$1.80	\$9.16	0.54	\$17.58	2.70	\$87.88	\$97.04
59		2	EA	\$9.50	\$19.34	0.42	\$13.67	0.84	\$27.34	\$46.68
60	200amp switch in Panel	1		\$1,000.00		8.00	\$260.38	8.00	\$260.38	\$1,278.38
61		1	EA	\$15,000.0	\$15,270.00	54.25	\$1,765.67	54.25	\$1,765.67	\$17,035.67
62	Remove Existing Trans.	1	EA	\$3,000.00	\$3,054.00	10.00	\$325.47	10.00	\$325.47	\$3,379.47

Subtotals:

\$35,403.45

398.07 \$12,956.08 \$48,359.53

Sales Tax:

0% \$0.00

 Overhead:
 10%
 \$4,835.95

 Profit:
 10%
 \$5,319.55

Subtotal:

\$58,515.04

Bond: Contingency: 1

0% \$0.00 10% \$5,851.50

**Grand Total:** 

\$64,366.54

Project Name:	COE FLW THERMAL STORAGE
Project Number:	930073-0017 ALTERNATIVE IH-3
Date:	April 05, 1995
Prepared By:	MELISSA RUSSO
Sheet:	PAGE 1
Department:	MECHANICAL-HVAC

Base Labor Rate:	
City Multiplier:	0%
Effective Labor Rate:	\$50.00

## **ESTIMATE OF CONSTRUCTION COST**

	ПЕМ	MATERIAL		LABOR ·				MATERIAL/ LABOR		
#	DESCRIPTION	QTY.	UNIT	COST/UNIT	TOTAL	HRS/UNIT	COST/UNIT		TOTAL COST	TOTAL
	ICE HARVESTOR	485	TONS	\$1,250.00	\$606,250.00	3.50	\$175.00	1697.50	\$84,875.00	\$691,125.00
	CLG TWR-625 TONS	1	EA	\$22,500.00	\$22,500.00	110.00	\$5,500.00	110.00	\$5,500.00	\$28,000.00
	HOISTING	1	LS		\$0.00		\$0.00	0.00	\$0.00	\$8,000.00
	TANK	1	EA		\$0.00		\$0.00	0.00	\$0.00	\$54,275.00
	PLATE HEAT EXCHNGR	1	EA	\$14,127.00	\$14,127.00	80.00	\$4,000.00	80.00	\$4,000.00	\$18,127.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
	CHILLED WTR SYSTEM				\$0.00		\$0.00	0.00	\$0.00	\$0.00
	PUMPS 1440 GPM	1	EA	\$3,803.00	\$3,803.00	18.00	\$900.00	18.00	\$900.00	\$4,703.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
	8" BUTTERFLY VALVES	6	EA	\$345.00	\$2,070.00	5.33	\$266.50	31.98	\$1,599.00	\$3,669.00
	THERMOMETERS	2	EA	\$33.00	\$66.00	0.25	\$12.50	0.50	\$25.00	\$91.00
	PRESSURE GAGES	2	EA	\$16.50	\$33.00	0.25	\$12.50	0.50	\$25.00	\$58.00
	RELIEF VALVES	1	EA	\$79.00	\$79.00	0.33	\$16.65	0.33	\$16.65	\$95.65
	1" BALL VALVES	8	EA	\$12.20	\$97.60	0.42	\$21.05	3.37	\$168.40	\$266.00
	GAGE COCKS	5	EA	\$12.20	\$61.00	0.42	\$21.05	2.11	\$105.25	\$166.25
	8" AIR SEPARATOR	1	EA	\$2,525.00	\$2,525.00	8.00	\$400.00	8.00	\$400.00	\$2,925.00
	FLEXIBLE CONNECTOR	2	EA	\$232.00	\$464.00	4.00	\$200.00	8.00	\$400.00	\$864.00
	CHEMICAL POT FEEDER	1	LS		\$0.00		\$0.00	0.00	\$0.00	\$2,000.00
	8" PIPING	400	LF	\$42.50	\$17,000.00	1.26	\$63.15	505.20	\$25,260.00	\$42,260.00
	2" PIPING	100	LF	\$5.30	\$530.00	0.12	\$5.90	11.80	\$590.00	\$1,120.00
	3/4" PIPING	50	LF	\$2.08	\$104.00	0.11	\$5.40	5.40	\$270.00	\$374.00
	8" INSULATION	400	LF	\$2.23	\$892.00	0.16	\$8.00	64.00	\$3,200.00	\$4,092.00
	2" INSULATION	100	LF	\$0.80	\$80.00	0.08	\$4.00	8.00	\$400.00	\$480.00
	3/4" INSULATION	50	LF	\$0.28	\$14.00	0.07	\$3.50	3.50	\$175.00	\$189.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
	150 GAL EXP TANK	1	EA	\$845.00	\$845.00	4.00	\$200.00	4.00	\$200.00	\$1,045.00
	FILL VALVE ASSEMBLY	1	EA	\$113.00	\$113.00	0.42	\$21.05	0.42	\$21.05	\$134.05
	MANUAL AIR VENT	1	EA	\$35.00	\$35.00	0.67	\$33.35	0.67	\$33.35	\$68.35
	1" STRAINER	1	EA	\$13.75	\$13.75	0.47	\$23.55	0.47	\$23.55	\$37.30
	TRIPLE DUTY VALVE	1	EA	\$1,338.00	\$1,338.00	6.00	\$300.00	6.00	\$300.00	\$1,638.00
-	SUCTION DIFFUSER	1	EA	\$1,053.00	\$1,053.00	4.00	\$200.00	4.00	\$200.00	\$1,253.00

Subtotals:

\$674,093.35

\$0.00

2573.75 \$128,687.25 \$867,055.60

Sales Tax:

Overhead: Profit: 
 10%
 \$86,705.56

 10%
 \$95,376.12

Subtotal:

\$1,049,137.28

Bond: Contingenc \$0.00 15% \$157,370.59

**Grand Total:** 

\$1,206,507.87

Project Name:	COE FLW THERMAL STORAGE
Project Number:	930073-0017 ALTERNATIVE IH-3
Date:	April 05, 1995
Prepared By:	MELISSA RUSSO
Sheet:	PAGE 2
Department:	MECHANICAL-HVAC

Base Labor Rate:	
City Multiplier:	0%
Effective Labor Rate:	\$50.00

## **ESTIMATE OF CONSTRUCTION COST**

ITEM			MATERIAL		LABOR .				MATERIAL/ LABOR	
#	DESCRIPTION	QTY.	UNIT	COST/UNIT	TOTAL	HRS/UNIT	COST/UNIT	TOTAL HRS	TOTAL COST	TOTAL
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
	CONDENSER WTR SYS				\$0.00		\$0.00	0.00	\$0.00	\$0.00
	PUMPS 1500 GPM	1	EA	\$2,693.00	\$2,693.00	18.00	\$900.00	18.00	\$900.00	\$3,593.00
	GRISWOLD SEPARATOR	1	EA	\$4,750.00	\$4,750.00	8.00	\$400.00	8.00	\$400.00	\$5,150.00
	8" BUTTERFLY VALVES	6	EA	\$345.00	\$2,070.00	5.33	\$266.50	31.98	\$1,599.00	\$3,669.00
	PRESSURE GAGES	3	EA	\$16.50	\$49.50	0.25	\$12.50	0.75	\$37.50	\$87.00
	BALANCING VALVES	1	EA	\$56.00	\$56.00	0.44	\$22.20	0.44	\$22.20	\$78.20
	AUTO PURGE VALVE	1	EA	\$1,050.00	\$1,050.00	0.73	\$36.35	0.73	\$36.35	\$1,086.35
	1"BALL VALVES	6	EA	\$12.20	\$73.20	0.42	\$21.05	2.53	\$126.30	\$199.50
	FLEXIBLE CONNECTOR	3	EA	\$340.00	\$1,020.00	4.50	\$225.00	13.50	\$675.00	\$1,695.00
	I-1/2" STRAINERS	2	EA	\$47.00	\$94.00	0.57	\$28.55	1.14	\$57.10	\$151.10
	THERMOMETERS	2	EA	\$33.00	\$66.00	0.25	\$12.50	0.50	\$25.00	\$91.00
	GAGE COCKS	7	EA	\$12.20	\$85.40	0.42	\$21.05	2.95	\$147.35	\$232.75
	8" PIPING	400	LF	\$42.50	\$17,000.00	1.26	\$63.15	505.20	\$25,260.00	\$42,260.00
	3" PIPING	50	LF	\$6.60	\$330.00	0.37	\$18.60	18.60	\$930.00	\$1,260.00
	2" VENT PIPING	10	LF	\$4.12	\$41.20	0.26	\$13.10	2.62	\$131.00	\$172.20
	1" DRAIN PIPING	15	LF	\$2.18	\$32.70	0.15	\$7.55	2.27	\$113.25	\$145.95
	1-1/2" BALL VALVES	3	EA	\$18.05	\$54.15	0.62	\$30.75	1.85	\$92.25	\$146.40
$\vdash$	CHEM FEED PUMP/TANK	1	LS		\$0.00		\$0.00	0.00	\$0.00	\$2,000.00
	SOLENOID VALVE	1	EA	\$410.00	\$410.00	0.75	\$37.50	0.75	\$37.50	\$447.50
	3" BUTTERFLY VALVES	2	EA	\$185.00	\$370.00	2.00	\$100.00	4.00	\$200.00	\$570.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
	TRIPLE DUTY VALVE	1	EA	\$1,338.00	\$1,338.00	6.00	\$300.00	6.00	\$300.00	\$1,638.00
	SUCTION DIFFUSER	1	EA	\$1,205.00	\$1,205.00	5.00	\$250.00	5.00	\$250.00	\$1,455.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
Г					\$0.00		\$0.00	0.00	\$0.00	\$0.00
Ι					\$0.00		\$0.00	0.00	\$0.00	\$0.00

Subtotals:

\$32,788.15

626.80 \$31,339.80 \$66,127.95

Sales Tax:

\$0.00

Overhead: 10% Profit:

\$6,612.80 \$6,612.80 10%

Subtotal:

\$79,353.54

Bond: Contingency:

\$0.00 15% \$11,903.03

**Grand Total:** 

\$91,256.57

a i dicci i iame.	COE FLW THERMAL STORAGE
Project Number:	930073-0017 ALTERNATIVE IH-3
Date:	April 05, 1995
Prepared By:	MELISSA RUSSO
	PAGE 3
Department:	MECHANICAL-HVAC

Base Labor Rate:	
City Multiplier:	0%
Effective Labor Rate:	\$50.00

## **ESTIMATE OF CONSTRUCTION COST**

ITEM			MATERIAL		LABOR				MATERIAL/ LABOR
# DESCRIPTION	QTY.	UNIT	COST/UNIT	TOTAL	RS/UNI	COST/UNIT	TOTAL HRS	TOTAL COST	TOTAL
				\$0.00		\$0.00	0.00	\$0.00	\$0.00
TANK PUMPING SYSTEM				\$0.00		\$0.00	0.00	\$0.00	\$0.00
VERT TURBINE PUMPS				\$0.00		\$0.00	0.00	\$0.00	\$0.00
2310 GPM	1	EA		\$0.00	32.00	\$1,600.00	32.00	\$1,600.00	\$1,600.00
10" BUTTERFLY VALVES	6	EA	\$425.00	\$2,550.00	6.00	\$300.00	36.00	\$1,800.00	\$4,350.00
THERMOMETERS	2	EA	\$33.00	\$66.00	0.25	\$12.50	0.50	\$25.00	\$91.00
PRESSURE GAGES	2	EA	\$16.50	\$33.00	0.25	\$12.50	0.50	\$25.00	\$58.00
RELIEF VALVES	1	EA	\$79.00	\$79.00	0.33	\$16.50	0.33	\$16.50	\$95.50
1" BALL VALVES	8	EA	\$12.20	\$97.60	0.42	\$21.05	3.37	\$168.40	\$266.00
GAGE COCKS	5	EA	\$12.20	\$61.00	0.42	\$21.05	2.11	\$105.25	\$166.25
FLEXIBLE CONNECTORS	1	EA	\$340.00	\$340.00	4.50	\$225.00	4.50	\$225.00	\$565.00
FLEXIBLE CONNECTOR	1	EA	\$52.00	\$52.00	0.50	\$25.00	0.50	\$25.00	\$77.00
2-WAY CONTROL VALVE	1	EA	\$365.00	\$365.00	0.75	\$37.50	0.75	\$37.50	\$402.50
				\$0.00		\$0.00	0.00	\$0.00	\$0.00
				\$0.00		\$0.00	0.00	\$0.00	\$0.00
10" PIPING	150	LF	\$73.00	\$10,950.00	1.50	\$75.00	225.00	\$11,250.00	\$22,200.00
				\$0.00		\$0.00	0.00	\$0.00	\$0.00
				\$0.00		\$0.00	0.00	\$0.00	\$0.00
10" INSULATION	150	LF	\$2.60	\$390.00	0.18	\$8.90	26.70	\$1,335.00	\$1,725.00
				\$0.00		\$0.00	0.00	\$0.00	\$0.00
				\$0.00		\$0.00	0.00	\$0.00	\$0.00
PROJ MAN/ MISC COSTS	1	LS		\$0.00		\$0.00	0.00	\$0.00	\$25,100.00
				\$0.00		\$0.00	0.00	\$0.00	\$0.00
SIESMIC	1	LS		\$0.00		\$0.00	0.00	\$0.00	\$10,000.00
				\$0.00		\$0.00	0.00	\$0.00	\$0.00
CONTROLS	1	LS		\$0.00		\$0.00	0.00	\$0.00	\$90,000.00
				\$0.00		\$0.00	0.00	\$0.00	\$0.00
BALANCING	1	LS		\$0.00		\$0.00	0.00	\$0.00	\$4,000.00
				\$0.00		\$0.00	0.00	\$0.00	\$0.00
				\$0.00		\$0.00	0.00	\$0.00	\$0.00
				\$0.00		\$0.00	0.00	\$0.00	\$0.00

Subtotals:

\$14,983.60

Overhead:

\$16,612.65 \$160,696.25

Sales Tax:

\$0.00

Profit:

332.25

10% \$16,069.63 10% \$16,069.63

Subtotal:

\$192,835.50

Bond: Contingency: \$0.00 15% \$28,925.33

**Grand Total:** 

\$221,760.83

Project Name:	Ft. Leonardwood Chiller Study - Alt. IH-3				
Project Number:	930073-0017				
Date:	August 17, 1995				
Prepared By:	S. Benway				
Sheet:	1 of 2				
Department:	Electrical				

Base Labor Rate:	\$28.50
City Multiplier (Labor):	114%
Effective Labor Rate:	\$32.55

City Multiplier	(Material):	102%

# ESTIMATE OF CONSTRUCTION COST

	ITEM			MATERIAL		LABOR				MATERIAL/ LABOR
#	DESCRIPTION	QTY.	UNIT	COST/UNIT	TOTAL	RS/UNI	COST/UNIT	TOTAL HRS	TOTAL COST	TOTAL
	Chiller Replacement				\$0.00		\$0.00	0.00	\$0.00	\$0.00
_	Demolition	1	LOT	n/a	\$0.00	86.64	\$2,820.00	86.64	\$2,820.00	\$2,820.00
_	Shielded, 5kv, #4, cu. wir	180	L.F.	\$1.00	\$183.90	0.04	\$1.30	7.20	\$234.34	\$418.24
	Cable Termination	12	EA	\$60.00	\$732.96	0.93	\$30.11	11.10	\$361.27	\$1,094.23
	Grounding	1	EA	\$200.00	\$203.60	1.85	\$60.05	1.85	\$60.05	\$263.65
5	1 1/2" emt Conduit	40	L.F.	\$1.43	\$58.23	0.09	\$2.90	3.56	\$115.87	\$174.10
6	1 1/2" emt Connector	6	EA	\$0.61	\$3.73	0.07	\$2.18	0.40	\$13.08	\$16.81
7	1 1/2" Conduit Hanger	4	EA	\$1.25	\$5.09	0.05	\$1.72	0.21	\$6.90	\$11.99
8	1 1/2" Flex Conduit	5	L.F.	\$0.31	\$1.58	0.04	\$1.30	0.20	\$6.51	\$8.09
9	1 1/2" Flex Connector	2	EA	\$1.00	\$2.04	0.10	\$3.25	0.20	\$6.51	\$8.55
10	5kv Fuse	3	EA	\$240.00	\$732.96	0.40	\$13.02	1.20	\$39.06	\$772.02
11	Connection to Equipment	1	EA	\$40.00	\$40.72	8.00	\$260.38	8.00	\$260.38	\$301.10
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
	Cooling Tower Fan-40hp				\$0.00		\$0.00	0.00	\$0.00	\$0.00
L	#1/0 thwn cu. conductor	150	L.F.	\$1.14	\$173.40	0.02	\$0.65	3.00	\$97.64	\$271.04
13	1 1/4" EMT conduit	40	L.F.	\$1.21	\$49.27	0.08	\$2.60	3.20	\$104.15	\$153.42
14	150amp fuse	3	EA	\$29.00	\$88.57	0.20	\$6.51	0.60	\$19.53	\$108.09
15	Connection to Equipment	1	EA	\$20.00	\$20.36	4.00	\$130.19	4.00	\$130.19	\$150.55
	Combo. Starter/Disc.	1	EA	\$1,360.51	\$1,385.00	10.60	\$345.00	10.60	\$345.00	\$1,730.00
17	1 1/4" Flex Conduit	5	L.F.	\$1.07	\$5.45	0.11	\$3.71	0.57	\$18.55	\$24.00
18	1 1/4" Flex Connector	2	EA	\$6.38	\$12.98	0.20	\$6.51	0.40	\$13.02	\$26.00
19	150amp switch in Panel	1	EA	\$918.38	\$934.91	2.00	\$65.09	2.00	\$65.09	\$1,000.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
	Chilled Water Pump-40hp				\$0.00		\$0.00	0.00	\$0.00	\$0.00
20	#1/0 thwn cu. conductor	150	L.F.	\$1.14	\$173.40	0.02	\$0.65	3.00	\$97.64	\$271.04
21	1 1/4" EMT conduit	40	L.F.	\$1.21	\$49.27	0.08	\$2.60	3.20	\$104.15	\$153.42
22	150amp fuse	3	EA	\$29.00	\$88.57	0.20	\$6.51	0.60	\$19.53	\$108.09
23	Connection to Equipment	1	EA	\$20.00	\$20.36	4.00	\$130.19	4.00	\$130.19	\$150.55
24	Combo. Starter/Disc.	1	EA	,	\$1,385.00	10.60	\$345.00	10.60	\$345.00	\$1,730.00
25	1 1/4" Flex Conduit	5	L.F.	\$1.07	\$5.45	0.11	\$3.71	0.57	\$18.55	\$24.00
26	1 1/4" Flex Connector	2	EA	\$6.38	\$12.98	0.20	\$6.51	0.40	\$13.02	\$26.00
27	150amp switch in Panel	1	, EA	\$918.38	\$934.91	2.00	\$65.09	2.00	\$65.09	\$1,000.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
	Surge Tank Pump-30hp				\$0.00		\$0.00	0.00	\$0.00	\$0.00
	#2 thwn cu. conductor	150	L.F.	\$0.55	\$83.83	0.02	\$0.65	3.00	\$97.64	\$181.47
	1 1/4" EMT conduit	40	L.F.	\$1.21	\$49.27	0.08	\$2.60	3.20	\$104.15	\$153.42
	120amp fuse	3	EA	\$29.00	\$88.57	0.20	\$6.51	0.60	\$19.53	\$108.09
	Connection to Equipment	-	EA	\$20.00	\$20.36	4.00	\$130.19	4.00	\$130.19	\$150.55
	Combo. Starter/Disc.	1	EA		\$1,381.00	10.60	\$345.00	10.60	\$345.00	\$1,726.00
	1 1/4" Flex Conduit	5	L.F.	\$1.07	\$5.45	0.11	\$3.71	0.57	\$18.55	\$24.00
	1 1/4" Flex Connector	2	EA	\$6.38	\$12.98	0.20	\$6.51	0.40	\$13.02	\$26.00
35	100amp switch in Panel	1	EA	\$918.38	\$934.91	2.00	\$65.09	2.00	\$65.09	\$1,000.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00

Project Name:	Ft. Leonardwood Chiller Study				
Project Number:	930073-0017				
Date:	August 17, 1995				
Prepared By:	S. Benway				
Sheet:	2 of 2				
Department:	Electrical				

Base Labor Rate:	\$28.50
City Multiplier (Labor):	114%
Effective Labor Rate:	\$32.55

City Multiplier (Material):	102%

# ESTIMATE OF CONSTRUCTION COST

ITEM			МАТЕ	RIAL		MATERIAL/ LABOR				
#	DESCRIPTION	QTY.	UNIT	COST/UNIT	TOTAL	RS/UNI	COST/UNIT	TOTAL HRS	TOTAL COST	TOTAL
	Cond. Water Pump-20hp				\$0.00		\$0.00	0.00	\$0.00	\$0.00
36	#3 thwn cu. conductor	150	L.F.	\$0.55	\$83.83	0.02	\$0.65	3.00	\$97.64	\$181.47
37	1 1/4" EMT conduit	40	L.F.	\$1.21	\$49.27	0.08	\$2.60	3.20	\$104.15	\$153.42
38	80amp fuse	3	EA	\$10.15	\$31.00	0.20	\$6.51	0.60	\$19.53	\$50.53
	Connection to Equipment	1	EA	\$20.00	\$20.36	4.00	\$130.19	4.00	\$130.19	\$150.55
		1	EA	\$852.65	\$868.00	7.01	\$228.00	7.01	\$228.00	\$1,096.00
41	1 1/4" Flex Conduit	5	L.F.	\$1.05	\$5.34	0.11	\$3.71	0.57	\$18.55	\$23.90
42	1 1/4" Flex Connector	2	EA	\$6.25	\$12.73	0.20	\$6.51	0.40	\$13.02	\$25.74
43	100amp switch in Panel	1	EA	\$525.45	\$534.91	2.00	\$65.09	2.00	\$65.09	\$600.00
	-				\$0.00		\$0.00	0.00	\$0.00	\$0.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
		<del>                                     </del>			\$0.00		\$0.00	0.00	\$0.00	\$0.00
			l		\$0.00		\$0.00	0.00	\$0.00	\$0.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00

Subtotals:

\$11,486.46

214.45 \$6,979.65 \$18,466.10

Sales Tax:

0% \$0.00

 Overhead:
 10%
 \$1,846.61

 Profit:
 10%
 \$2,031.27

10% \$2,031.27

Subtotal:

\$22,343.98

Bond: Contingency:

0% \$0.00 10% \$2,234.40

**Grand Total:** 

\$24,578.38

	COE FLW THERMAL STORAGE
Project Number:	930073-0017 ALTERNATIVE IH-4
Date:	April 05, 1995
Prepared By:	MELISSA RUSSO
Sheet:	PAGE 1
Department:	MECHANICAL-HVAC

Base Labor Rate:	
City Multiplier:	0%
Effective Labor Rate:	\$50.00

## **ESTIMATE OF CONSTRUCTION COST**

ITEM			MATER	IAL		LABOR .				
# DESCRIPTION	QTY.	UNIT	COST/UNIT	TOTAL	RS/UNI	COST/UNIT	TOTAL HRS	TOTAL COST	TOTAL	
ICE HARVESTOR	485	TONS	\$1,250.00	\$606,250.00	3.50	\$175.00	1697.50	\$84,875.00	\$691,125.00	
CLG TWR-975 TONS	1	EA	\$18,500.00	\$18,500.00	110.00	\$5,500.00	110.00	\$5,500.00	\$24,000.00	
HOISTING			,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	\$0.00		\$0.00	0.00	\$0.00	\$8,000.00	
TANK	1	EA		\$0.00		\$0.00	0.00	\$0.00	\$97,825.00	
PLATE HEAT EXCHNGR	1	EA	\$23,523.00	\$23,523.00	100.00	\$5,000.00	100.00	\$5,000.00	\$28,523.00	
				\$0.00		\$0.00	0.00	\$0.00	\$0.00	
CHILLED WTR SYSTEM				\$0.00		\$0.00	0.00	\$0.00	\$0.00	
PUMPS 1440 GPM	1	EA	\$3,803.00	\$3,803.00	18.00	\$900.00	18.00	\$900.00	\$4,703.00	
				\$0.00		\$0.00	0.00	\$0.00	\$0.00	
8" BUTTERFLY VALVES	6	EA	\$345.00	\$2,070.00	5.33	\$266.50	31.98	\$1,599.00	\$3,669.00	
THERMOMETERS	2	EA	\$33.00	\$66.00	0.25	\$12.50	0.50	\$25.00	\$91.00	
PRESSURE GAGES	2	EA	\$16.50	\$33.00	0.25	\$12.50	0.50	\$25.00	\$58.00	
RELIEF VALVES	1	EA	\$79.00	\$79.00	0.33	\$16.65	0.33	\$16.65	\$95.65	
1" BALL VALVES	8	EA	\$12.20	\$97.60	0.42	\$21.05	3.37	\$168.40	\$266.00	
GAGE COCKS	5	EA	\$12.20	\$61.00	0.42	\$21.05	2.11	\$105.25	\$166.25	
8" AIR SEPARATOR	1	EA	\$2,525.00	\$2,525.00	8.00	\$400.00	8.00	\$400.00	\$2,925.00	
FLEXIBLE CONNECTOR	2	EA	\$232.00	\$464.00	4.00	\$200.00	8.00	\$400.00	\$864.00	
CHEMICAL POT FEEDER	1	LS		\$0.00		\$0.00	0.00	\$0.00	\$2,000.00	
8" PIPING	400	LF	\$42.50	\$17,000.00	1.26	\$63.15	505.20	\$25,260.00	\$42,260.00	
2" PIPING	100	LF	\$5.30	\$530.00	0.12	\$5.90	11.80	\$590.00	\$1,120.00	
3/4" PIPING	50	LF	\$2.08	\$104.00	0.11	\$5.40	5.40	\$270.00	\$374.00	
8" INSULATION	400	LF	\$2.23	\$892.00	0.16	\$8.00	64.00	\$3,200.00	\$4,092.00	
2" INSULATION	50	LF	\$0.80	\$40.00	0.08	\$4.00	4.00	\$200.00	\$240.00	
3/4" INSULATION	50	LF	\$0.28	\$14.00	0.07	\$3.50	3.50	\$175.00	\$189.00	
	1			\$0.00		\$0.00	0.00	\$0.00	\$0.00	
150 GAL EXP TANK	1	EA		\$0.00	4.00	\$200.00	4.00	\$200.00	\$200.00	
FILL VALVE ASSEMBLY	1	EA	\$113.00	\$113.00	0.42	\$21.05	0.42	\$21.05	\$134.05	
MANUAL AIR VENT	1	EA	\$35.00	\$35.00	0.67	\$33.35	0.67	\$33.35	\$68.35	
1" STRAINER	1	EA	\$13.75	\$13.75	0.47	\$23.55	0.47	\$23.55	\$37.30	
TRIPLE DUTY VALVE	1	EA	\$2,208.00	\$2,208.00	8.00	\$400.00	8.00	\$400.00	\$2,608.00	
SUCTION DIFFUSER	1	EA	\$1,053.00	\$1,053.00	6.00	\$300.00	6.00	\$300.00	\$1,353.00	

Subtotals: \$679,474.35 2593.75 \$129,687.25 \$916,986.60

 Sales Tax:
 \$0.00
 Overhead:
 10%
 \$91,698.66

 Profit:
 10%
 \$100,868.53

Subtotal: \$1,109,553.79

Bond: \$0.00 Contingency: 15% \$166,433.07

Grand Total: \$1,275,986.85

Project Name:	COE FLW THERMAL STORAGE
Project Number:	930073-0017 ALTERNATIVE IH-4
Date:	April 05, 1995
Prepared By:	MELISSA RUSSO
Sheet:	PAGE 2
Department:	MECHANICAL-HVAC

Base Labor Rate:	
City Multiplier:	0%
Effective Labor Rate:	\$50.00

## **ESTIMATE OF CONSTRUCTION COST**

ITEM				MATERIAL		LABOR				MATERIAL/ LABOR
#	DESCRIPTION	QTY.	UNIT	COST/UNIT	TOTAL	HRS/UNIT	COST/UNIT	TOTAL HRS	TOTAL COST	TOTAL
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
	CONDENSER WTR SYS				\$0.00		\$0.00	0.00	\$0.00	\$0.00
	PUMPS 2340 GPM	1	EA	\$5,943.00	\$5,943.00	24.00	\$1,200.00	24.00	\$1,200.00	\$7,143.00
	GRISWOLD SEPARATOR	1	EA	\$4,750.00	\$4,750.00	8.00	\$400.00	8.00	\$400.00	\$5,150.00
	10" BUTTERFLY VALVES	6	EA	\$425.00	\$2,550.00	6.00	\$300.00	36.00	\$1,800.00	\$4,350.00
	PRESSURE GAGES	3	EA	\$16.50	\$49.50	0.25	\$12.50	0.75	\$37.50	\$87.00
	BALANCING VALVES	1	EA	\$56.00	\$56.00	0.44	\$22.20	0.44	\$22.20	\$78.20
	AUTO PURGE VALVE	1	EA	\$1,050.00	\$1,050.00	0.73	\$36.35	0.73	\$36.35	\$1,086.35
	1"BALL VALVES	6	EA	\$12.20	\$73.20	0.42	\$21.05	2.53	\$126.30	\$199.50
	FLEXIBLE CONNECTOR	3	EA	\$340.00	\$1,020.00	4.50	\$225.00	13.50	\$675.00	\$1,695.00
	1-1/2" STRAINERS	2	EA	\$47.00	\$94.00	0.57	\$28.55	1.14	\$57.10	\$151.10
	THERMOMETERS	2	EA	\$33.00	\$66.00	0.25	\$12.50	0.50	\$25.00	\$91.00
	GAGE COCKS	7	EA	\$12.20	\$85.40	0.42	\$21.05	2.95	\$147.35	\$232.75
	10" PIPING	400	LF	\$73.00	\$29,200.00	1.50	\$75.00	600.00	\$30,000.00	\$59,200.00
	3" PIPING	50	LF	\$6.60	\$330.00	0.37	\$18.60	18.60	\$930.00	\$1,260.00
	2" VENT PIPING	10	LF	\$4.12	\$41.20	0.26	\$13.10	2.62	\$131.00	\$172.20
	1" DRAIN PIPING	15	LF	\$2.18	\$32.70	0.15	\$7.55	2.27	\$113.25	\$145.95
	1-1/2" BALL VALVES	3	EA	\$18.05	\$54.15	0.62	\$30.75	1.85	\$92.25	\$146.40
	CHEM FEED PUMP/TANK	1	LS		\$0.00		\$0.00	0.00	\$0.00	\$2,000.00
	SOLENOID VALVE	1	EA	\$410.00	\$410.00	0.75	\$37.50	0.75	\$37.50	\$447.50
	3" BUTTERFLY VALVES	2	EA	\$185.00	\$370.00	2.00	\$100.00	4.00	\$200.00	\$570.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
	TRIPLE DUTY VALVE	1	EA	\$2,208.00	\$2,208.00	8.00	\$400.00	8.00	\$400.00	\$2,608.00
	SUCTION DIFFUSER	1	EA	\$2,093.00	\$2,093.00	8.00	\$400.00	8.00	\$400.00	\$2,493.00
$\Box$					\$0.00		\$0.00	0.00	\$0.00	\$0.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00

Subtotals:

\$50,476.15

\$36,830.80 \$89,306.95 736.62

Sales Tax:

\$0.00

10% \$8,930.70 Overhead: \$8,930.70 Profit: 10%

Subtotal:

\$107,168.34

Bond:

\$0.00 \$16,075.25 15% Contingency:

Grand Total:

\$123,243.59

	COE FLW THERMAL STORAGE
Project Number:	930073-0017 ALTERNATIVE IH-4
Date:	April 05, 1995
Prepared By:	MELISSA RUSSO
Sheet:	PAGE 3
Department:	MECHANICAL-HVAC

Base Labor Rate:	
City Multiplier:	0%
Effective Labor Rate:	\$50.00

## **ESTIMATE OF CONSTRUCTION COST**

ІТЕМ	MATER	IAL	LABOR				MATERIAL/ LABOR		
# DESCRIPTION	QTY.	UNIT	COST/UNIT	TOTAL	HRS/UNIT	COST/UNIT	TOTAL HRS	TOTAL COST	TOTAL
				\$0.00		\$0.00	0.00	\$0.00	\$0.00
TANK PUMPING SYSTEM				\$0.00	V	\$0.00	0.00	\$0.00	\$0.00
VERT TURBINE PUMPS				\$0.00		\$0.00	0.00	\$0.00	\$0.00
3600 GPM	1	EA	\$13,835.00	\$13,835.00	60.00	\$3,000.00	60.00	\$3,000.00	\$16,835.00
12" BUTTERFLY VALVES	6	EA	\$595.00	\$3,570.00	8.00	\$400.00	48.00	\$2,400.00	\$5,970.00
THERMOMETERS	2	EA	\$33.00	\$66.00	0.25	\$12.50	0.50	\$25.00	\$91.00
PRESSURE GAGES	2	EA	\$16.50	\$33.00	0.25	\$12.50	0.50	\$25.00	\$58.00
RELIEF VALVES	1	EA	\$79.00	\$79.00	0.33	\$16.50	0.33	\$16.50	\$95.50
1" BALL VALVES	8	EA	\$12.20	\$97.60	0.42	\$21.05	3.37	\$168.40	\$266.00
GAGE COCKS	5	EA	\$12.20	\$61.00	0.42	\$21.05	2.11	\$105.25	\$166.25
FLEXIBLE CONNECTORS	1	EA	\$340.00	\$340.00	4.50	\$225.00	4.50	\$225.00	\$565.00
FLEXIBLE CONNECTORS	1	EA	\$52.00	\$52.00	0.50	\$25.00	0.50	\$25.00	\$77.00
2-WAY CONTROL VALVE	1	EA	\$365.00	\$365.00	0.75	\$37.50	0.75	\$37.50	\$402.50
				\$0.00		\$0.00	0.00	\$0.00	\$0.00
12" PIPING	200	LF	\$94.00	\$18,800.00	1.71	\$85.70	342.80	\$17,140.00	\$35,940.00
10" PIPING	200	LF	\$73.00	\$14,600.00	1.50	\$75.00	300.00	\$15,000.00	\$29,600.00
				\$0.00		\$0.00	0.00	\$0.00	\$0.00
12" INSULATION	200	LF	\$2.96	\$592.00	0.20	\$10.00	40.00	\$2,000.00	\$2,592.00
10" INSULATION	200	LF	\$2.60	\$520.00	0.18	\$8.90	35.60	\$1,780.00	\$2,300.00
				\$0.00		\$0.00	0.00	\$0.00	\$0.00
				\$0.00		\$0.00	0.00	\$0.00	\$0.00
				\$0.00		\$0.00	0.00	\$0.00	\$0.00
PROJ MAN. /MISC COSTS	1	LS		\$0.00		\$0.00	0.00	\$0.00	\$29,000.00
				\$0.00		\$0.00	0.00	\$0.00	\$0.00
SIESMIC	1	LS		\$0.00		\$0.00	0.00	\$0.00	\$10,000.00
				\$0.00		\$0.00	0.00	\$0.00	\$0.00
CONTROLS	1	LS		\$0.00		\$0.00	0.00	\$0.00	\$96,000.00
				\$0.00		\$0.00	0.00	\$0.00	\$0.00
BALANCING	1	LS		\$0.00		\$0.00	0.00	\$0.00	\$4,000.00
				\$0.00		\$0.00	0.00	\$0.00	\$0.00
				\$0.00		\$0.00	0.00	\$0.00	\$0.00

Subtotals:

\$53,010.60

838.95 \$41,947.65 \$233,958.25

Sales Tax:

\$0.00

 Overhead:
 10%

 Profit:
 10%

10%\$23,395.8310%\$23,395.83

Subtotal:

\$280,749.90

Bond: Contingency:

\$0.00 15% \$42,112.49

**Grand Total:** 

\$322,862.39

Project Name:	Ft. Leonardwood Chiller Study
Project Number:	930073-0017
Date:	August 17, 1995
Prepared By:	S. Benway
Sheet:	2 of 2
Department:	Electrical

Base Labor Rate:	\$28.50
City Multiplier (Labor):	114%
Effective Labor Rate:	\$32.55

102%

## **ESTIMATE OF CONSTRUCTION COST**

ITEM			MATERIAL		LABOR				MATERIAL/ LABOR	
#	DESCRIPTION	QTY.	UNIT	COST/UNIT	TOTAL	RS/UNI	COST/UNIT	TOTAL HRS	TOTAL COST	TOTAL
	Cond. Water Pump-25hp				\$0.00		\$0.00	0.00	\$0.00	\$0.00
37	#4 thwn cu. conductor	180	L.F.	\$0.39	\$71.46	0.02	\$0.65	3.60	\$117.17	\$188.63
38	1 1/4" EMT conduit	50	L.F.	\$1.21	\$61.59	0.08	\$2.60	4.00	\$130.19	\$191.78
39	90amp fuse	3	EA	\$10.15	\$31.00	0.20	\$6.51	0.60	\$19.53	\$50.53
40	Connection to Equipment	1	EA	\$30.00	\$30.54	4.09	\$133.17	4.09	\$133.17	\$163.71
41	Combo. Starter/Disc.	1	EA	\$1,356.58	\$1,381.00	10.60	\$345.00	10.60	\$345.00	\$1,726.00
42	1 1/4" Flex Conduit	5	L.F.	\$1.07	\$5.45	0.11	\$3.58	0.55	\$17.90	\$23.35
43	1 1/4" Flex Connector	2	EA	\$6.38	\$12.99	0.20	\$6.51	0.40	\$13.02	\$26.01
44	100amp switch in Panel	1	EA	\$918.38	\$934.91	2.00	\$65.09	2.00	\$65.09	\$1,000.00
					\$0.00	,	\$0.00	0.00	\$0.00	\$0.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
┢					\$0.00		\$0.00	0.00	\$0.00	\$0.00
$\Box$					\$0.00		\$0.00	0.00	\$0.00	\$0.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
$\vdash$					\$0.00		\$0.00	0.00	\$0.00	\$0.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
			·		\$0.00		\$0.00	0.00	\$0.00	\$0.00
$\vdash$					\$0.00		\$0.00	0.00	\$0.00	\$0.00

Subtotals:

\$14,906.20

324.24 \$10,552.91 \$25,459.11

Sales Tax:

0% \$0.00

 Overhead:
 10%

 Profit:
 10%

10% \$2,545.91 10% \$2,800.50

Subtotal:

\$30,805.52

Bond: Contingency:

0% \$0.00 10% \$3,080.55

**Grand Total:** 

\$33,886.07

Project Name:	Ft. Leonardwood Chiller Study - Alt. IH-4
Project Number:	930073-0017
Date:	August 17, 1995
Prepared By:	S. Benway
Sheet:	1 of 2
Department:	Electrical

Base Labor Rate:	\$28.50
City Multiplier (Labor):	114%
Effective Labor Rate:	\$32.55

City Multiplier (Material):	102%
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# ESTIMATE OF CONSTRUCTION COST

ГТЕМ			MATERIAL		LABOR				MATERIAL/ LABOR	
#	DESCRIPTION	QTY.	UNIT	COST/UNIT	TOTAL	RS/UNI	COST/UNIT	TOTAL HRS	TOTAL COST	TOTAL
	Chiller Replacement				\$0.00		\$0.00	0.00	\$0.00	\$0.00
	Demolition	. 1	LOT	n/a	\$0.00	86.64	\$2,820.00	86.64	\$2,820.00	\$2,820.00
	Shielded, 5kv, #3/0, cu. w	180	L.F.	\$2.75	\$504.00	0.04	\$1.43	7.90	\$257.00	\$761.00
	Cable Termination	12	EA	\$98.23	\$1,200.00	1.23	\$40.00	14.75	\$480.00	\$1,680.01
	Grounding	1	LOT	n/a	\$0.00	6.15	\$200.00	6.15	\$200.00	\$200.00
	2 1/2" Rigid Conduit	40	L.F.	\$5.60	\$228.00	0.18	\$5.70	7.01	\$228.00	\$456.00
6	2 1/2" Rigid Connector	6	EA	\$7.86	\$48.00	1.23	\$40.00	7.37	\$240.00	\$288.00
7	2 1/2" Conduit Hanger	4	EA	\$9.82	\$40.00	0.61	\$20.00	2.46	\$80.00	\$120.00
8	2 1/2" Flex Conduit	5	L.F.	\$2.16	\$11.00	0.23	\$7.60	1.17	\$38.00	\$49.00
9	2 1/2" Flex Connector	2	EA	\$23.58	\$48.00	0.35	\$11.50	0.71	\$23.00	\$71.00
10	5kv Fuse	3	EA	\$294.70	\$900.00	4.82	\$157.00	14.47	\$471.00	\$1,371.00
11	2" Elbow	2	EA	\$22.60	\$46.00	0.88	\$28.50	1.75	\$57.00	\$103.00
12	Connection to Equipment	1	LOT	n/a	\$0.00	7.99	\$260.00	7.99	\$260.00	\$260.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
	Chilled Water Pump-40hp				\$0.00		\$0.00	0.00	\$0.00	\$0.00
13	#1/0 thwn cu. conductor	150	L.F.	\$1.14	\$173.40	0.02	\$0.65	3.00	\$97.64	\$271.04
14	1 1/4" EMT conduit	40	L.F.	\$1.21	\$49.27	0.08	\$2.60	3.20	\$104.15	\$153.42
15	150amp fuse	3	EA	\$29.00	\$88.57	0.20	\$6.51	0.60	\$19.53	\$108.09
16	Connection to Equipment	1	EA	\$20.00	\$20.36	4.00	\$130.19	4.00	\$130.19	\$150.55
17	Combo. Starter/Disc.	1	EA	\$1,360.51	\$1,385.00	10.60	\$345.00	10.60	\$345.00	\$1,730.00
18	1 1/4" Flex Conduit	5	L.F.	\$1.07	\$5.45	0.11	\$3.71	0.57	\$18.55	\$24.00
19	1 1/4" Flex Connector	2	EA	\$6.38	\$12.98	0.20	\$6.51	0.40	\$13.02	\$26.00
20	150amp switch in Panel	1	EA	\$918.38	\$934.91	2.00	\$65.09	2.00	\$65.09	\$1,000.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
	Surge Tank Pump-50hp				\$0.00		\$0.00	0.00	\$0.00	\$0.00
21	#1 thwn cu. conductor	150	L.F.	\$1.60	\$244.32	0.12	\$3.75	17.27	\$561.99	\$806.31
22	1 1/2" EMT conduit	40	L.F.	\$1.90	\$77.37	0.18	\$5.86	7.20	\$234.34	\$311.71
23	175amp fuse	3	EA	\$21.00	\$64.13	0.60	\$19.53	1.80	\$58.58	\$122.72
24	Connection to Equipment	1	EA	\$160.50	\$163.39	12.00	\$390.56	12.00	\$390.56	\$553.95
25	Combo. Starter/Disc.	1	EA	\$1,400.00	\$1,425.20	11.00	\$358.02	11.00	\$358.02	\$1,783.22
26	1 1/2" Flex Conduit	5	L.F.	\$1.80	\$9.16	0.54	\$17.58	2.70	\$87.88	\$97.04
27	1 1/2" Flex Connector	2	EA	\$9.50	\$19.34	0.42	\$13.67	0.84	\$27.34	\$46.68
28	200amp switch in Panel	1	EA	\$1,000.00	\$1,018.00	8.00	\$260.38	8.00	\$260.38	\$1,278.38
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
	Cooling Tower Fan-60hp				\$0.00		\$0.00	0.00	\$0.00	\$0.00
29	#2/0 thwn cu. conductor	150	L.F.	\$1.17	\$178.66	0.03	\$0.98	4.50	\$146.46	\$325.12
	2" EMT conduit	40	L.F.	\$1.91	\$77.78	0.10	\$3.25	4.00	\$130.19	\$207.96
31	200amp fuse	3	EA	\$22.50	\$68.72	0.22	\$7.23	0.67	\$21.68	\$90.39
	Connection to Equipment	1	EA	\$300.00	\$305.40	20.00	\$650.94	20.00	\$650.94	\$956.34
	Combo. Starter/Disc.	1	EA	\$1,943.67	\$1,978.66	16.00	\$520.75	16.00	\$520.75	\$2,499.41
34	2" Flex Conduit	5	L.F.	\$1.80	\$9.16	0.20	\$6.51	1.00	\$32.55	\$41.71
	2" Flex Connector	2	EA	\$12.30	\$25.04	0.35	\$11.33	0.70	\$22.65	\$47.70
	200amp switch in Panel	1	EA	\$1,000.00	\$1,018.00	8.00	\$260.38	8.00	\$260.38	\$1,278.38

Project Name:	Ft. Leonardwood Chiller Study
Project Number:	930073-0017
Date:	August 17, 1995
Prepared By:	S. Benway
Sheet:	2 of 2
Department:	Electrical

Base Labor Rate:	\$28.50
City Multiplier (Labor):	114%
Effective Labor Rate:	\$32.55

City Multiplier (Material):	102%
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## **ESTIMATE OF CONSTRUCTION COST**

ІТЕМ			MATERIAL		LABOR				MATERIAL/ LABOR	
#	DESCRIPTION	QTY.	UNIT	COST/UNIT	TOTAL	RS/UNI	COST/UNIT	TOTAL HRS	TOTAL COST	TOTAL
	Cond. Water Pump-25hp	`			\$0.00		\$0.00	0.00	\$0.00	\$0.00
	#4 thwn cu. conductor	180	L.F.	\$0.39	\$71.46	0.02	\$0.65	3.60	\$117.17	\$188.63
38	1 1/4" EMT conduit	50	L.F.	\$1.21	\$61.59	0.08	\$2.60	4.00	\$130.19	\$191.78
39	90amp fuse	3	EA	\$10.15	\$31.00	0.20	\$6.51	0.60	\$19.53	\$50.53
	Connection to Equipment	1	EA	\$30.00	\$30.54	4.09	\$133.17	4.09	\$133.17	\$163.71
41	Combo. Starter/Disc.	1	EA	\$1,356.58	\$1,381.00	10.60	\$345.00	10.60	\$345.00	\$1,726.00
42	1 1/4" Flex Conduit	5	L.F.	\$1.07	\$5.45	0.11	\$3.58	0.55	\$17.90	\$23.35
43	1 1/4" Flex Connector	2	EA	\$6.38	\$12.99	0.20	\$6.51	0.40	\$13.02	\$26.01
44	100amp switch in Panel	1	EA	\$918.38	\$934.91	2.00	\$65.09	2.00	\$65.09	\$1,000.00
	1				\$0.00		\$0.00	0.00	\$0.00	\$0.00
$\vdash$					\$0.00		\$0.00	0.00	\$0.00	\$0.00
$\vdash$					\$0.00		\$0.00	0.00	\$0.00	\$0.00
$\vdash$					\$0.00		\$0.00	0.00	\$0.00	\$0.00
$\vdash$		1			\$0.00		\$0.00	0.00	\$0.00	\$0.00
<u> </u>					\$0.00		\$0.00	0.00	\$0.00	\$0.00
-					\$0.00		\$0.00	0.00	\$0.00	\$0.00
-					\$0.00		\$0.00	0.00	\$0.00	\$0.00
<u> </u>		<del>                                     </del>			\$0.00		\$0.00	0.00	\$0.00	\$0.00
$\vdash$		1			\$0.00		\$0.00	0.00	\$0.00	\$0.00
$\vdash$				<b>†</b>	\$0.00		\$0.00	0.00	\$0.00	\$0.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
		1			\$0.00		\$0.00	0.00	\$0.00	\$0.00
<b> </b>					\$0.00		\$0.00	0.00	\$0.00	\$0.00
<b>—</b>				1	\$0.00		\$0.00	0.00	\$0.00	\$0.00
		1			\$0.00		\$0.00	0.00	\$0.00	\$0.00
-				1	\$0.00		\$0.00	0.00	\$0.00	\$0.00
$\vdash$		1			\$0.00		\$0.00	0.00	\$0.00	\$0.00
			1		\$0.00		\$0.00	0.00	\$0.00	\$0.00
-		1			\$0.00	1	\$0.00	0.00	\$0.00	\$0.00
-		1		<b>†</b>	\$0.00		\$0.00	0.00	\$0.00	\$0.00
					\$0.00	1	\$0.00	0.00	\$0.00	\$0.00

Subtotals:

\$14,906.20

324.24 \$10,552.91 \$25,459.11

10%

Sales Tax:

0% \$0.00

Overhead: 10% \$2,545.91

Subtotal:

Profit:

\$30,805.52

\$2,800.50

Bond: Contingency:

0% \$0.00 10% \$3,080.55

**Grand Total:** 

\$33,886.07

K i Olece i vame.	COE FLW THERMAL STORAGE
Project Number:	930073-0017 ALTERNATIVE IH-5
Date:	April 05, 1995
Prepared By:	MELISSA RUSSO
Sheet:	PAGE 1
Department:	MECHANICAL-HVAC

Base Labor Rate:	
City Multiplier:	0%
Effective Labor Rate:	\$50.00

# ESTIMATE OF CONSTRUCTION COST

ITEM		MATERI	IAL	LABOR				MATERIAL/ LABOR	
# DESCRIPTION	QTY.	UNIT	COST/UNIT	TOTAL	RS/UNI	COST/UNIT	TOTAL HRS	TOTAL COST	TOTAL
ICE HARVESTOR	485	TONS	\$1,250.00	\$606,250.00	3.50	\$175.00	1697.50	\$84,875.00	\$691,125.00
CLG TWR-820 TONS	1	EA	\$14,500.00	\$14,500.00	110.00	\$5,500.00	110.00	\$5,500.00	\$20,000.00
HOISTING	1	LS		\$0.00		\$0.00	0.00	\$0.00	\$8,000.00
TANK	1	EA		\$0.00		\$0.00	0.00	\$0.00	\$49,725.00
PLATE HEAT EXCHNGR	1	EA	\$18,500.00	\$18,500.00	100.00	\$5,000.00	100.00	\$5,000.00	\$23,500.00
				\$0.00		\$0.00	0.00	\$0.00	\$0.00
CHILLED WTR SYSTEM				\$0.00		\$0.00	0.00	\$0.00	\$0.00
PUMPS 1440 GPM	1	EA	\$3,803.00	\$3,803.00	18.00	\$900.00	18.00	\$900.00	\$4,703.00
				\$0.00		\$0.00	0.00	\$0.00	\$0.00
8" BUTTERFLY VALVES	6	EA	\$345.00	\$2,070.00	5.33	\$266.50	31.98	\$1,599.00	\$3,669.00
THERMOMETERS	2	EA	\$33.00	\$66.00	0.25	\$12.50	0.50	\$25.00	\$91.00
PRESSURE GAGES	2	EA	\$16.50	\$33.00	0.25	\$12.50	0.50	\$25.00	\$58.00
RELIEF VALVES	1	EA	\$79.00	\$79.00	0.33	\$16.65	0.33	\$16.65	\$95.65
1" BALL VALVES	8	EA	\$12.20	\$97.60	0.42	\$21.05	3.37	\$168.40	\$266.00
GAGE COCKS	5	EA	\$12.20	\$61.00	0.42	\$21.05	2.11	\$105.25	\$166.25
8" AIR SEPARATOR	1	EA	\$2,525.00	\$2,525.00	8.00	\$400.00	8.00	\$400.00	\$2,925.00
FLEXIBLE CONNECTOR	2	EA	\$232.00	\$464.00	4.00	\$200.00	8.00	\$400.00	\$864.00
CHEMICAL POT FEEDER	1	LS		\$0.00		\$0.00	0.00	\$0.00	\$2,000.00
8" PIPING	400	LF	\$56.00	\$22,400.00	1.26	\$63.15	505.20	\$25,260.00	\$47,660.00
2" PIPING	100	LF	\$5.30	\$530.00	0.12	\$5.90	11.80	\$590.00	\$1,120.00
3/4" PIPING	50	LF	\$2.08	\$104.00	0.11	\$5.40	5.40	\$270.00	\$374.00
8" INSULATION	400	LF	\$2.23	\$892.00	0.16	\$8.00	64.00	\$3,200.00	\$4,092.00
2" INSULATION	100	LF	\$0.80	\$80.00	0.08	\$4.00	8.00	\$400.00	\$480.00
3/4" INSULATION	50	LF	\$0.28	\$14.00	0.07	\$3.50	3.50	\$175.00	\$189.00
				\$0.00		\$0.00	0.00	\$0.00	\$0.00
150 GAL EXP TANK	1	EA	\$845.00	\$845.00	4.00	\$200.00	4.00	\$200.00	\$1,045.00
FILL VALVE ASSEMBLY	1	EA	\$113.00	\$113.00	0.42	\$21.05	0.42	\$21.05	\$134.05
MANUAL AIR VENT	1	EA	\$35.00	\$35.00	0.67	\$33.35	0.67	\$33.35	\$68.35
1" STRAINER	1	EA	\$13.75	\$13.75	0.47	\$23.55	0.47	\$23.55	\$37.30
TRIPLE DUTY VALVE	1	EA	\$2,208.00	\$2,208.00	8.00	\$400.00	8.00	\$400.00	\$2,608.00
SUCTION DIFFUSER	1	EA	\$1,053.00	\$1,053.00	6.00	\$300.00	6.00	\$300.00	\$1,353.00

Subtotals:

\$676,736.35

2597.75 \$129,887.25 \$866,348.60

Sales Tax: \$0.00

 Overhead:
 10%
 \$86,634.86

 Profit:
 10%
 \$95,298.35

Subtotal:

\$1,048,281.81

Bond: \$0.00 Contingency: 15% \$157,242.27

**Grand Total:** 

\$1,205,524.08

Project Name:	COE FLW THERMAL STORAGE
Project Number:	930073-0017 ALTERNATIVE IH-5
Date:	April 05, 1995
Prepared By:	MELISSA RUSSO
Sheet:	PAGE 2
Department:	MECHANICAL-HVAC

Base Labor Rate:	
City Multiplier:	0%
Effective Labor Rate:	\$50.00

## **ESTIMATE OF CONSTRUCTION COST**

	ITEM	MATERIAL		LABOR .				MATERIAL/ LABOR		
#	DESCRIPTION	QTY.	UNIT	COST/UNIT	TOTAL	HRS/UNIT	COST/UNIT	TOTAL HRS	TOTAL COST	TOTAL
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
	CONDENSER WTR SYS				\$0.00		\$0.00	0.00	\$0.00	\$0.00
	PUMPS 1970 GPM	1	EA	\$5,773.00	\$5,773.00	24.00	\$1,200.00	24.00	\$1,200.00	\$6,973.00
	GRISWOLD SEPARATOR	1	EA	\$4,750.00	\$4,750.00	8.00	\$400.00	8.00	\$400.00	\$5,150.00
	10" BUTTERFLY VALVES	6	EA	\$425.00	\$2,550.00	6.00	\$300.00	36.00	\$1,800.00	\$4,350.00
	PRESSURE GAGES	3	EA	\$16.50	\$49.50	0.25	\$12.50	0.75	\$37.50	\$87.00
	BALANCING VALVES	1	EA	\$56.00	\$56.00	0.44	\$22.20	0.44	\$22.20	\$78.20
	AUTO PURGE VALVE	1	EA	\$1,050.00	\$1,050.00	0.73	\$36.35	0.73	\$36.35	\$1,086.35
	I"BALL VALVES	6	EA	\$12.20	\$73.20	0.42	\$21.05	2.53	\$126.30	\$199.50
	FLEXIBLE CONNECTOR	3	EA	\$340.00	\$1,020.00	4.50	\$225.00	13.50	\$675.00	\$1,695.00
	1-1/2" STRAINERS	2	EA	\$47.00	\$94.00	0.57	\$28.55	1.14	\$57.10	\$151.10
	THERMOMETERS	2	EA	\$33.00	\$66.00	0.25	\$12.50	0.50	\$25.00	\$91.00
	GAGE COCKS	7	EA	\$12.20	\$85.40	0.42	\$21.05	2.95	\$147.35	\$232.75
	10" PIPING	400	LF	\$73.00	\$29,200.00	1.50	\$75.00	600.00	\$30,000.00	\$59,200.00
	3" PIPING	50	LF	\$6.60	\$330.00	0.37	\$18.60	18.60	\$930.00	\$1,260.00
	2" VENT PIPING	10	LF	\$4.12	\$41.20	0.26	\$13.10	2.62	\$131.00	\$172.20
	1" DRAIN PIPING	15	LF	\$2.18	\$32.70	0.15	\$7.55	2.27	\$113.25	\$145.95
	1-1/2" BALL VALVES	3	EA	\$18.05	\$54.15	0.62	\$30.75	1.85	\$92.25	\$146.40
	CHEM FEED PUMP/TANK	1	EA		\$0.00		\$0.00	0.00	\$0.00	\$2,000.00
	SOLENOID VALVE	1	EA	\$410.00	\$410.00	0.75	\$37.50	0.75	\$37.50	\$447.50
	3" BUTTERFLY VALVES	2	EA	\$185.00	\$370.00	2.00	\$100.00	4.00	\$200.00	\$570.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
	TRIPLE DUTY VALVE	1	EA	\$2,208.00	\$2,208.00	8.00	\$400.00	8.00	\$400.00	\$2,608.00
	SUCTION DIFFUSER	1	EA	\$2,093.00	\$2,093.00	6.00	\$300.00	6.00	\$300.00	\$2,393.00
$\vdash$					\$0.00		\$0.00	0.00	\$0.00	\$0.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
			1		\$0.00		\$0.00	0.00	\$0.00	\$0.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00

Subtotals:

\$50,306.15

734.62 \$36,730.80 \$89,036.95

Sales Tax:

\$0.00

Overhead: Profit:

10% \$8,903.70 \$8,903.70 10%

Subtotal:

\$106,844.34

Bond:

\$0.00 Contingency: 15% \$16,026.65

**Grand Total:** 

\$122,870.99

Project Name:	COE FLW THERMAL STORAGE
Project Number:	930073-0017 ALTERNATIVE IH-5
Date:	April 05, 1995
Prepared By:	MELISSA RUSSO
Sheet:	PAGE 3
Department:	MECHANICAL-HVAC

Base Labor Rate:	
City Multiplier:	0%
Effective Labor Rate:	\$50.00

## **ESTIMATE OF CONSTRUCTION COST**

	ITEM			MATER	IAL		MATERIAL/ LABOR			
#	DESCRIPTION	QTY.	UNIT	COST/UNIT	TOTAL	HRS/UNIT	COST/UNIT	TOTAL HRS	TOTAL COST	TOTAL
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
	TANK PUMPING SYSTEM				\$0.00		\$0.00	0.00	\$0.00	\$0.00
	VERT TURBINE PUMPS				\$0.00		\$0.00	0.00	\$0.00	\$0.00
	3025 GPM		EA	\$9,740.00	\$0.00	60.00	\$3,000.00	0.00	\$0.00	\$0.00
	12" BUTTERFLY VALVES	6	EA	\$595.00	\$3,570.00	8.00	\$400.00	48.00	\$2,400.00	\$5,970.00
	THERMOMETERS	2	EA	\$33.00	\$66.00	0.25	\$12.50	0.50	\$25.00	\$91.00
	PRESSURE GAGES	2	EA	\$16.50	\$33.00	0.25	\$12.50	0.50	\$25.00	\$58.00
	RELIEF VALVES	1	EA	\$79.00	\$79.00	0.33	\$16.50	0.33	\$16.50	\$95.50
	I" BALL VALVES	8	EA	\$12.20	\$97.60	0.42	\$21.05	3.37	\$168.40	\$266.00
	GAGE COCKS	5	EA	\$12.20	\$61.00	0.42	\$21.05	2.11	\$105.25	\$166.25
	FLEXIBLE CONNECTORS	1	EA	\$340.00	\$340.00	4.50	\$225.00	4.50	\$225.00	\$565.00
	FLEXIBLE CONNECTORS	1	EA	\$52.00	\$52.00	0.50	\$25.00	0.50	\$25.00	\$77.00
	2-WAY CONTROL VALV	1	EA	\$365.00	\$365.00	0.75	\$37.50	0.75	\$37.50	\$402.50
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
	12" PIPING	200	LF	\$94.00	\$18,800.00	1.71	\$85.70	342.80	\$17,140.00	\$35,940.00
	10" PIPING	200	LF	\$73.00	\$14,600.00	1.50	\$75.00	300.00	\$15,000.00	\$29,600.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
	12" INSULATION	200	LF	\$2.96	\$592.00	0.20	\$10.00	40.00	\$2,000.00	\$2,592.00
	10" INSULATION	200	LF	\$2.60	\$520.00	0.18	\$8.90	35.60	\$1,780.00	\$2,300.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
	PROJ MAN/ MISC COSTS	1	LS		\$0.00		\$0.00	0.00	\$0.00	\$29,500.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
	SEISMIC	1	LS		\$0.00		\$0.00	0.00	\$0.00	\$10,000.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
	CONTROLS	1	LS		\$0.00		\$0.00	0.00	\$0.00	\$96,750.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
	BALANCING	1	LS		\$0.00		\$0.00	0.00	\$0.00	\$4,000.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00

Subtotals:

\$39,175.60

778.95 \$38,947.65 \$218,373.25

Sales Tax:

\$0.00

Overhead: Profit:

10% \$21,837.33 \$21,837.33 10%

Subtotal:

\$262,047.90

Bond:

\$0.00 15% \$39,307.19 Contingency:

**Grand Total:** 

\$301,355.09

Project Name:	Ft. Leonardwood Chiller Study - Alt. IH-5
Project Number:	930073-0017
Pate:	August 17, 1995
Prepared By:	S. Benway
Sheet:	1 of 2
Department:	Electrical

Base Labor Rate:	\$28.50
City Multiplier (Labor):	114%
Effective Labor Rate:	\$32.55

City Multiplier (Material):	102%
( )	

# ESTIMATE OF CONSTRUCTION COST

ITEM				MATE	RIAL		MATERIAL/ LABOR			
#	DESCRIPTION	QTY.	UNIT	COST/UNIT	TOTAL	RS/UNI	COST/UNIT	TOTAL HRS	TOTAL COST	TOTAL
	Chiller Replacement				\$0.00		\$0.00	0.00	\$0.00	\$0.00
	Demolition	1	LOT	n/a	\$0.00	86.64	\$2,820.00	86.64	\$2,820.00	\$2,820.00
2	Shielded, 5kv, #3/0, cu. w	180	L.F.	\$2.75	\$504.00	0.04	\$1.43	7.90	\$257.00	\$761.00
3	Cable Termination	12	EA	\$98.23	\$1,200.00	1.23	\$40.00	14.75	\$480.00	\$1,680.01
4	Grounding	1	LOT	n/a	\$0.00	6.15	\$200.00	6.15	\$200.00	\$200.00
5	2 1/2" Rigid Conduit	40	L.F.	\$5.60	\$228.00	0.18	\$5.70	7.01	\$228.00	\$456.00
6	2 1/2" Rigid Connector	6	EA	\$7.86	\$48.00	1.23	\$40.00	7.37	\$240.00	\$288.00
7	2 1/2" Conduit Hanger	4	EA	\$9.82	\$40.00	0.61	\$20.00	2.46	\$80.00	\$120.00
8	2 1/2" Flex Conduit	5	L.F.	\$2.16	\$11.00	0.23	\$7.60	1.17	\$38.00	\$49.00
9	2 1/2" Flex Connector	2	EA	\$23.58	\$48.00	0.35	\$11.50	0.71	\$23.00	\$71.00
10	5kv Fuse	3	EA	\$294.70	\$900.00	4.82	\$157.00	14.47	\$471.00	\$1,371.00
11	2" Elbow	2	EA	\$22.60	\$46.00	0.88	\$28.50	1.75	\$57.00	\$103.00
12	Connection to Equipment	1	LOT	n/a	\$0.00	7.99	\$260.00	7.99	\$260.00	\$260.00
_					\$0.00		\$0.00	0.00	\$0.00	\$0.00
	Chilled Water Pump-40hp				\$0.00		\$0.00	0.00	\$0.00	\$0.00
13	#1/0 thwn cu. conductor	150	L.F.	\$1.14	\$173.40	0.02	\$0.65	3.00	\$97.64	\$271.04
14	1 1/4" EMT conduit	40	L.F.	\$1.21	\$49.27	0.08	\$2.60	3.20	\$104.15	\$153.42
15	150amp fuse	3	EA	\$29.00	\$88.57	0.20	\$6.51	0.60	\$19.53	\$108.09
16	Connection to Equipment	1	EA	\$20.00	\$20.36	4.00	\$130.19	4.00	\$130.19	\$150.55
17	Combo. Starter/Disc.	1	EA	\$1,360.51	\$1,385.00	10.60	\$345.00	10.60	\$345.00	\$1,730.00
18	1 1/4" Flex Conduit	5	L.F.	\$1.07	\$5.45	0.11	\$3.71	0.57	\$18.55	\$24.00
19	1 1/4" Flex Connector	2	EA	\$6.38	\$12.98	0.20	\$6.51	0.40	\$13.02	\$26.00
20	150amp switch in Panel	1	EA	\$918.38	\$934.91	2.00	\$65.09	2.00	\$65.09	\$1,000.00
	•				\$0.00		\$0.00	0.00	\$0.00	\$0.00
	Surge Tank Pump-40hp				\$0.00		\$0.00	0.00	\$0.00	\$0.00
21	#1/0 thwn cu. conductor	150	L.F.	\$1.14	\$173.40	0.02	\$0.65	3.00	\$97.64	\$271.04
22		40	L.F.	\$1.21	\$49.27	0.08	\$2.60	3.20	\$104.15	\$153.42
23	150amp fuse	3	EA	\$29.00	\$88.57	0.20	\$6.51	0.60	\$19.53	\$108.09
24		1	EA	\$20.00	\$20.36	4.00	\$130.19	4.00	\$130.19	\$150.55
25		1	EA	\$1,360.51	\$1,385.00	10.60	\$345.00	10.60	\$345.00	\$1,730.00
	1 1/4" Flex Conduit	5	L.F.	\$1.07	\$5.45	0.11	\$3.71	0.57	\$18.55	\$24.00
	1 1/4" Flex Connector	2	EA	\$6.38	\$12.98	0.20	\$6.51	0.40	\$13.02	\$26.00
	150amp switch in Panel	1	EA	\$918.38	\$934.91	2.00	\$65.09	2.00	\$65.09	\$1,000.00
<del>                                     </del>				†	\$0.00		\$0.00	0.00	\$0.00	\$0.00
$\vdash$	Cooling Tower Fan-60hp				\$0.00		\$0.00	0.00	\$0.00	\$0.00
29	#2/0 thwn cu. conductor	150	L.F.	\$1.17	\$178.66	0.03	\$0.98	4.50	\$146.46	\$325.12
	2" EMT conduit	40	L.F.	\$1.91	\$77.78	0.10	\$3.25	4.00	\$130.19	\$207.96
1	200amp fuse	3	EA	\$22.50	\$68.72	0.22	\$7.23	0.67	\$21.68	\$90.39
	Connection to Equipment		EA	\$300.00	\$305.40	20.00	\$650.94	20.00	\$650.94	\$956.34
	Combo. Starter/Disc.	1	EA	\$1,943.67	\$1,978.66	16.00	\$520.75	16.00	\$520.75	\$2,499.41
	2" Flex Conduit	5	L.F.	\$1.80	\$9.16	0.20	\$6.51	1.00	\$32.55	\$41.71
	2" Flex Connector	2	EA	\$12.30	\$25.04	0.35	\$11.33	0.70	\$22.65	\$47.70
	200amp switch in Panel	1	EA		\$1,018.00	8.00	\$260.38	8.00	\$260.38	\$1,278.38

Project Name:	Ft. Leonardwood Chiller Study				
Project Number:	930073-0017				
Date:	August 17, 1995				
Prepared By:	S. Benway				
Sheet:	2 of 2				
Department:	Electrical				

Base Labor Rate:	\$28.50
City Multiplier (Labor):	114%
Effective Labor Rate:	\$32.55

City Multiplier (Material):	102%
-----------------------------	------

# ESTIMATE OF CONSTRUCTION COST

	ІТЕМ		MATERIAL			MATERIAL/ LABOR				
#	DESCRIPTION	QTY.	UNIT	COST/UNIT	TOTAL	RS/UNI	COST/UNIT	TOTAL HRS	TOTAL COST	TOTAL
	Cond. Water Pump-20hp				\$0.00		\$0.00	0.00	\$0.00	\$0.00
37	#3 thwn cu. conductor	150	L.F.	\$0.55	\$83.83	0.02	\$0.65	3.00	\$97.64	\$181.47
38	1 1/4" EMT conduit	40	L.F.	\$1.21	\$49.27	0.08	\$2.60	3.20	\$104.15	\$153.42
39	80amp fuse	3	EA	\$10.15	\$31.00	0.20	\$6.51	0.60	\$19.53	\$50.53
40	Connection to Equipment	1	EA	\$20.00	\$20.36	4.00	\$130.19	4.00	\$130.19	\$150.55
41	Combo. Starter/Disc.	1	EA	\$852.65	\$868.00	7.01	\$228.00	7.01	\$228.00	\$1,096.00
42	1 1/4" Flex Conduit	5	L.F.	\$1.05	\$5.34	0.11	\$3.71	0.57	\$18.55	\$23.90
43	1 1/4" Flex Connector	2	EA	\$6.25	\$12.73	0.20	\$6.51	0.40	\$13.02	\$25.74
44	100amp switch in Panel	1	EA	\$525.45	\$534.91	2.00	\$65.09	2.00	\$65.09	\$600.00
$\vdash$					\$0.00		\$0.00	0.00	\$0.00	\$0.00
┢					\$0.00		\$0.00	0.00	\$0.00	\$0.00
$\vdash$					\$0.00		\$0.00	0.00	\$0.00	\$0.00
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					\$0.00		\$0.00	0.00	\$0.00	\$0.00
<b>-</b>					\$0.00		\$0.00	0.00	\$0.00	\$0.00
$\vdash$					\$0.00		\$0.00	0.00	\$0.00	\$0.00
一		1			\$0.00		\$0.00	0.00	\$0.00	\$0.00
┢					\$0.00		\$0.00	0.00	\$0.00	\$0.00
$\vdash$		<b></b>			\$0.00		\$0.00	0.00	\$0.00	\$0.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
$\vdash$					\$0.00		\$0.00	0.00	\$0.00	\$0.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
<u> </u>					\$0.00		\$0.00	0.00	\$0.00	\$0.00
$\vdash$					\$0.00	1	\$0.00	0.00	\$0.00	\$0.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
$\vdash$					\$0.00		\$0.00	0.00	\$0.00	\$0.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
				1	\$0.00		\$0.00	0.00	\$0.00	\$0.00
$\vdash$					\$0.00		\$0.00	0.00	\$0.00	\$0.00

Subtotals:

\$13,631.71

282.73 \$9,202.11 \$22,833.82

Sales Tax: 09

0% \$0.00

 Overhead:
 10%
 \$2,283.38

 Profit:
 10%
 \$2,511.72

Subtotal:

\$27,628.92

Bond: Contingency:

0% \$0.00 10% \$2,762.89

**Grand Total:** 

\$30,391.81

# ICE TANK SYSTEM COST ESTIMATES

Project Name:	COE FLW THERMAL STORAGE	
Project Number:	930073-0017 ALTERNATIVE IT-1	
Date:	August 02, 1995	
Prepared By:	GRH	
	PAGE 1	
	MECHANICAL-HVAC	

Base Labor Rate:	
City Multiplier:	0%
Effective Labor Rate:	\$50.00

## ESTIMATE OF CONSTRUCTION COST

ITEM			MATERIAL		LABOR				LABOR
# DESCRIPTION	QTY.	UNIT	COST/UNIT	TOTAL	HRS/UNIT	COST/UNIT	TOTAL HRS	TOTAL COST	TOTAL
ICE TANKS	3300	TONS-HRS	\$44.00	\$145,200.00					\$145,200.00
CLG TWR-890 TONS	890	TON	\$40.00	\$35,600.00	100.00	\$6.25		\$5,562.50	\$41,162.50
HOISTING	1	LS							\$8,000.00
ICE MACHINE 400 TONS	400	TON	\$375.00	\$150,000.00	100.00	\$105.00	i ji ji ngagayar	\$42,000.00	\$192,000.00
NIGHT CHILLER 400 TO	400	TON	\$180.00	\$72,000.00	100.00	\$105.00		\$42,000.00	\$114,000.00
								The parties of the pa	
CHILLED WTR SYSTEM						u jaar oo saata			
PUMP 1440 GPM	1	EA	\$3,803.00	\$3,803.00	18.00	\$900.00	i sa prijikir	\$900.00	\$4,703.00
						4 1 1 4 4 4	Nation 19	gad spile as	e la especial
8" BUTTERFLY VALVES	6	EA	\$345.00	\$2,070.00	5.33 ·	\$266.50	Rab Balanci	\$1,599.00	\$3,669.00
THERMOMETERS	2	EA	\$33.00	\$66.00	0.25	\$12.50		\$25.00	\$91.00
PRESSURE GAGES	2	EA	\$16.50	\$33.00	0.25	\$12.50		\$25.00	\$58.00
RELIEF VALVES	1	EA	\$79.00	\$79.00	0.33	\$16.65	achtaloppi	\$16.65	\$95.65
1" BALL VALVES	8	EA	\$12.20	\$97.60	0.42	\$21.05		\$168.40	\$266.00
GAGE COCKS	5	EA	\$12.20	\$61.00	0.42	\$21.05		\$105.25	\$166.25
8" AIR SEPARATOR	1	EA	\$2,525.00	\$2,525.00	8.00	\$400.00		\$400.00	\$2,925.00
FLEXIBLE CONNECTOR	2	EA	\$232.00	\$464.00	4.00	\$200.00		\$400.00	\$864.00
CHEMICAL POT FEEDER	1	ls				To real they are			\$2,000.00
8" PIPING	400	LF	\$42.50	\$17,000.00	1.26	\$63.15		\$25,260.00	\$42,260.00
2" PIPING	100	LF	\$5.30	\$530.00	0.12	\$5.90	main galgiga	\$590.00	\$1,120.00
3/4" PIPING	50	LF	\$2.08	\$104.00	0.11	\$5.40	PREVEN	\$270.00	\$374.00
8" INSULATION	400	LF	\$2.23	\$892.00	0.16	\$8.00		\$3,200.00	\$4,092.00
2" INSULATION	100	LF	\$0.80	\$80.00	0.08	\$4.00		\$400.00	\$480.00
3/4" INSULATION	50	LF	\$0.28	\$14.00	0.07	\$3.50		\$175.00	\$189.00
				projetjaji de proj		erata e estris	i li li ja jakhiji		i ingsett j
150 GAL EXP TANK	1	EA	\$845.00	\$845.00	4.00	\$200.00		\$200.00	\$1,045.00
FILL VALVE ASSEMBLY	1	EA	\$113.00	\$113.00	0.42	\$21.05		\$21.05	\$134.05
MANUAL AIR VENT	1	EA	\$35.00	\$35.00	0.67	\$33.35		\$33.35	\$68.35
1" STRAINER	1	EA	\$13.75	\$13.75	0.47	\$23.55		\$23.55	\$37.30
TRIPLE DUTY VALVE	1	EA	\$1,338.00	\$1,338.00	6.00	\$300.00	11,117,23	\$300.00	\$1,638.00
SUCTION DIFFUSER	1	EA	\$1,205.00	\$1,205.00	5.00	\$250.00		\$250.00	\$1,455.00

Subtotals:

\$434,168.35

\$123,924.75 \$568,093.10

Sales Tax:

\$0.00

 Overhead:
 10%
 \$56,809.31

 Profit:
 10%
 \$62,490.24

Subtotal:

\$687,392.65

Bond: Contingenc

\$0.00
\$103,108.90

**Grand Total:** 

\$790,501.55

Project Name:	COE FLW THERMAL STORAGE
Project Number:	930073-0017 ALTERNATIVE IT-1
Date:	August 02, 1995
Prepared By:	GRH
Sheet:	PAGE 2
Department:	MECHANICAL-HVAC

Base Labor Rate:	
City Multiplier:	0%
Effective Labor Rate:	\$50.00

## **ESTIMATE OF CONSTRUCTION COST**

	ITEM			MATERIAL			MATERIAL/ LABOR			
#	DESCRIPTION	QTY.	UNIT	COST/UNIT	TOTAL	HRS/UNIT	COST/UNIT	TOTAL HRS	TOTAL COST	TOTAL
							1,460, 360	sharran	Maria di	
	CONDENSER WTR SYS									Alteria
	PUMPS 2160 GPM	1	EA	\$5,943.00	\$5,943.00	18.00	\$1,200.00		\$1,200.00	<b>\$</b> 7,143.00
	GRISWOLD SEPARATOR	. 1	EA	\$4,750.00	\$4,750.00	8.00	\$400.00	e de militar e la ser	\$400.00	\$5,150.00
	10" BUTTERFLY VALVE	6	EA	\$425.00	\$2,550.00	6.00	\$300.00	CONSTITUTE OF THE SECOND	\$1,800.00	\$4,350.00
	PRESSURE GAGES	3	EA	\$16.50	\$49.50	0.25	\$12.50		\$37.50	\$87.00
	BALANCING VALVES	1	EA	\$56.00	\$56.00	0.44	\$22.20	riggraphijska	\$22.20	\$78.20
	AUTO PURGE VALVE	1	EA	\$1,050.00	\$1,050.00	0.73	\$36.35		\$36.35	\$1,086.35
	1"BALL VALVES	6	EA	\$12.20	\$73.20	0.42	\$21.05		\$126.30	\$199.50
	FLEXIBLE CONNECTOR	3	EA	\$340.00	\$1,020.00	4.50 .	\$225.00		\$675.00	\$1,695.00
	1-1/2" STRAINERS	2	EA	\$47.00	\$94.00	0.57	\$28.55		\$57.10	\$151.10
	THERMOMETERS	2	EA	\$33.00	\$66.00	0.25	\$12.50		\$25.00	\$91.00
_	GAGE COCKS	7	EA	\$12.20	\$85.40	0.42	\$21.05		\$147.35	\$232.75
	10" PIPING	400	LF	\$73.00	\$29,200.00	1.50	\$75.00		\$30,000.00	\$59,200.00
	3" PIPING	50	LF	\$6.60	\$330.00	0.37	\$18.60		\$930.00	\$1,260.00
	2" VENT PIPING	10	LF	\$4.12	\$41.20	0.26	\$13.10		\$131.00	\$172.20
	1" DRAIN PIPING	15	LF	\$2.18	\$32.70	0.15	\$7.55		\$113.25	\$145.95
	1-1/2" BALL VALVES	3	EA	\$18.05	\$54.15	0.62	\$30.75		\$92.25	\$146.40
	CHEM FEED PUMP/TAN	1	LS		14/200		Twing Fit Car			\$2,000.00
	SOLENOID VALVE	1	EA	\$410.00	\$410.00	0.75	\$37.50		\$37.50	\$447.50
	3" BUTTERFLY VALVES	2	EA	\$185.00	\$370.00	2.00	\$100.00	e din e julia e di te	\$200.00	<b>\$</b> 570.00
					2 4 5					
	TRIPLE DUTY VALVE	1	EA	\$1,338.00	\$1,338.00	8.00	\$400.00		\$400.00	\$1,738.00
	SUCTION DIFFUSER	1	EA	\$1,205.00	\$1,205.00	6.00	\$300.00		\$300.00	\$1,505.00
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Subtotals: \$48,718.15 \$36,730.80 \$87,448.95

 Sales Tax:
 \$0.00
 Overhead:
 10%
 \$8,744.90

 Profit:
 10%
 \$8,744.90

Subtotal: \$104,938.74

 Bond:
 \$0.00

 Contingency:
 15%
 \$15,740.81

**Grand Total:** \$120,679.55

	TOOL THE WATER ALL CTOP A CE
Project Name:	COE FLW THERMAL STORAGE
Project Number:	930073-0017 ALTERNATIVE IT-1
Date:	August 02, 1995
Prepared By:	GRH
Sheet:	PAGE 3
Department:	MECHANICAL-HVAC

Base Labor Rate:	
City Multiplier:	0%
Effective Labor Rate:	\$50.00

## **ESTIMATE OF CONSTRUCTION COST**

ITEM			MATERL	AL		MATERIAL/ LABOR			
# DESCRIPTION	QTY.	UNIT	COST/UNIT	TOTAL	HRS/UNIT	COST/UNIT	TOTAL HRS	TOTAL COST	TOTAL
PROJ MAN/MISC COSTS	1	LS		\$0.00		\$0.00	0.00	\$0.00	\$39,900.00
				ng araba k					
SIESMIC	1	LS		\$0.00		\$0.00	0.00	\$0.00	\$10,000.00
								ijitor - Kara	
CONTROLS	1	LS		\$0.00		\$0.00	0.00	\$0.00	\$90,000.00
						nethay a			
BALANCING	1	LS		\$0.00		\$0.00	0.00	\$0.00	\$4,000.00
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	-			No.			3.10		

\$0.00 Subtotals:

\$143,900.00 0.00 \$0.00

Sales Tax: \$0.00

10% \$14,390.00 Overhead: \$14,390.00 10% **Profit:** 

Subtotal:

\$172,680.00

\$0.00 Bond: 15% \$25,902.00 Contingency:

**Grand Total:** 

\$198,582.00

Project Name:	Ft. Leonardwood Chiller Study - Alt. IT-1
Project Number:	930073-0017
Date:	August 17, 1995
Prepared By:	S. Benway
Sheet:	1 of 2
Department:	Electrical

Base Labor Rate:	\$28.50
City Multiplier (Labor):	114%
Effective Labor Rate:	\$32.55

City Multiplier (Material):	102%

# ESTIMATE OF CONSTRUCTION COST

ITEM			MATERIAL		LABOR				MATERIAL/ LABOR	
#		QTY.	UNIT	COST/UNIT	TOTAL	RS/UNI	COST/UNIT	TOTAL HRS	TOTAL COST	TOTAL
	Chiller #1 Replacement				\$0.00	24.41	\$0.00	0.00	\$0.00	\$0.00
	Demolition	1	LOT	n/a	\$0.00	86.64	\$2,820.00	86.64	\$2,820.00	\$2,820.00
		180	L.F.	\$2.75	\$504.00	0.04	\$1.43	7.90	\$257.00	\$761.00
	Cable Termination	12	EA	\$98.23	\$1,200.00	1.23	\$40.00	14.75	\$480.00	\$1,680.01
	Grounding	1	LOT	n/a	\$0.00	6.15	\$200.00	6.15	\$200.00	\$200.00
	2 1/2" Rigid Conduit	40	L.F.	\$5.60	\$228.00	0.18	\$5.70	7.01	\$228.00	\$456.00
	2 1/2" Rigid Connector	6	EA	\$7.86	\$48.00	1.23	\$40.00	7.37	\$240.00	\$288.00
	2 1/2" Conduit Hanger	4	EA	\$9.82	\$40.00	0.61	\$20.00	2.46	\$80.00	\$120.00
8	2 1/2" Flex Conduit	5	L.F.	\$2.16	\$11.00	0.23	\$7.60	1.17	\$38.00	\$49.00
9	2 1/2" Flex Connector	2	EA	\$23.58	\$48.00	0.35	\$11.50	0.71	\$23.00	\$71.00
10	5kv Fuse	3	EA	\$294.70	\$900.00	4.82	\$157.00	14.47	\$471.00	\$1,371.00
11	2" Elbow	2	EA	\$22.60	\$46.00	0.88	\$28.50	1.75	\$57.00	\$103.00
12	Connection to Equipment	1	LOT	n/a	\$0.00	7.99	\$260.00	7.99	\$260.00	\$260.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
	Chiller #2 Replacement				\$0.00		\$0.00	0.00	\$0.00	\$0.00
13	Demolition	1	LOT	n/a	\$0.00	86.64	\$2,820.00	86.64	\$2,820.00	\$2,820.00
14	Shielded, 5kv, #3/0, cu. w	180	L.F.	\$2.75	\$504.00	0.04	\$1.43	7.90	\$257.00	\$761.00
15	Cable Termination	12	EA	\$98.23	\$1,200.00	1.23	\$40.00	14.75	\$480.00	\$1,680.01
16	Grounding	1	LOT	n/a	\$0.00	6.15	\$200.00	6.15	\$200.00	\$200.00
	2 1/2" Rigid Conduit	40	L.F.	\$5.60	\$228.00	0.18	\$5.70	7.01	\$228.00	\$456.00
	2 1/2" Rigid Connector	6	EA	\$7.86	\$48.00	1.23	\$40.00	7.37	\$240.00	\$288.00
	2 1/2" Conduit Hanger	4	EA	\$9.82	\$40.00	0.61	\$20.00	2.46	\$80.00	\$120.00
	2 1/2" Flex Conduit	5	L.F.	\$2.16	\$11.00	0.23	\$7.60	1.17	\$38.00	\$49.00
	2 1/2" Flex Connector	2	EA	\$23.58	\$48.00	0.35	\$11.50	0.71	\$23.00	\$71.00
	5kv Fuse	3	EA	\$294.70	\$900.00	4.82	\$157.00	14.47	\$471.00	\$1,371.00
	2" Elbow	2	EA	\$22.60	\$46.00	0.88	\$28.50	1.75	\$57.00	\$103.00
	Connection to Equipment	1	LOT	n/a	\$0.00	7.99	\$260.00	7.99	\$260.00	\$260.00
-					\$0.00		\$0.00	0.00	\$0.00	\$0.00
	Chilled Water Pump-40hp				\$0.00		\$0.00	0.00	\$0.00	\$0.00
25	#1/0 thwn cu. conductor	150	L.F.	\$1.14	\$173.40	0.02	\$0.65	3.00	\$97.64	\$271.04
	1 1/4" EMT conduit	40	L.F.	\$1.21	\$49.27	0.08	\$2.60	3.20	\$104.15	\$153.42
	150amp fuse	3	EA	\$29.00	\$88.57	0.20	\$6.51	0.60	\$19.53	\$108.09
	Connection to Equipment	1	EA	\$20.00	\$20.36	4.00	\$130.19	4.00	\$130.19	\$150.55
	Combo. Starter/Disc.	1	EA	\$1,360.51	\$1,385.00	10.60	\$345.00	10.60	\$345.00	\$1,730.00
	1 1/4" Flex Conduit	5	L.F.	\$1.07	\$5.45	0.11	\$3.71	0.57	\$18.55	\$24.00
	1 1/4" Flex Connector	2	EA	\$6.38	\$12.98	0.20	\$6.51	0.40	\$13.02	\$26.00
	150amp switch in Panel	1	EA	\$918.38	\$934.91	2.00	\$65.09	2.00	\$65.09	\$1,000.00
ے۔	To our portion in a unor	亡	<u> </u>	1	\$0.00	1	\$0.00	0.00	\$0.00	\$0.00
<del> </del>		-	-	1	\$0.00		\$0.00	0.00	\$0.00	\$0.00
<u> </u>		<b>†</b>	<del> </del>	<del> </del>	\$0.00	1	\$0.00	0.00	\$0.00	\$0.00
<b>-</b>		-	-	<del>                                     </del>	\$0.00		\$0.00	0.00	\$0.00	\$0.00
<u> </u>		-	-	<del>                                     </del>	\$0.00	<del>                                     </del>	\$0.00	0.00	\$0.00	\$0.00
		-	-	<del> </del>	\$0.00	<del> </del>	\$0.00	0.00	\$0.00	\$0.00

Project Name:	Ft. Leonardwood Chiller Study
Project Number:	930073-0017
Date:	August 17, 1995
Prepared By:	S. Benway
Sheet:	2 of 2
Department:	Electrical

Base Labor Rate:	\$28.50
City Multiplier (Labor):	114%
Effective Labor Rate:	\$32.55

	10001
City Multiplier (Material):	102%

## **ESTIMATE OF CONSTRUCTION COST**

ITEM		MATERIAL		LABOR				MATERIAL/ LABOR		
#	DESCRIPTION	QTY.	UNIT	COST/UNIT	TOTAL	RS/UNI	COST/UNIT	TOTAL HRS	TOTAL COST	TOTAL
	Cooling Tower Fan-60hp				\$0.00		\$0.00	0.00	\$0.00	\$0.00
33	#2/0 thwn cu. conductor	150	L.F.	\$1.17	\$178.66	0.03	\$0.98	4.50	\$146.46	\$325.12
34	2" EMT conduit	40	L.F.	\$1.91	\$77.78	0.10	\$3.25	4.00	\$130.19	\$207.96
35	200amp fuse	3	EA	\$22.50	\$68.72	0.22	\$7.23	0.67	\$21.68	\$90.39
36	Connection to Equipment	1	EA	\$300.00	\$305.40	20.00	\$650.94	20.00	\$650.94	\$956.34
37	Combo. Starter/Disc.	1	EA	\$1,943.67	\$1,978.66	16.00	\$520.75	16.00	\$520.75	\$2,499.41
38	2" Flex Conduit	5	L.F.	\$1.80	\$9.16	0.20	\$6.51	1.00	\$32.55	\$41.71
39	2" Flex Connector	2	EA	\$12.30	\$25.04	0.35	\$11.33	0.70	\$22.65	\$47.70
40	200amp switch in Panel	1	EA	\$1,000.00	\$1,018.00	8.00	\$260.38	8.00	\$260.38	\$1,278.38
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
	Cond. Water Pump-20hp				\$0.00		\$0.00	0.00	\$0.00	\$0.00
36	#3 thwn cu. conductor	150	L.F.	\$0.55	\$83.83	0.02	\$0.65	3.00	\$97.64	\$181.47
37	1 1/4" EMT conduit	40	L.F.	\$1.21	\$49.27	0.08	\$2.60	3.20	\$104.15	\$153.42
38	80amp fuse	3	EA	\$10.15	\$31.00	0.20	\$6.51	0.60	\$19.53	\$50.53
	Connection to Equipment	1	EA	\$20.00	\$20.36	4.00	\$130.19	4.00	\$130.19	\$150.55
	Combo. Starter/Disc.	1	EA	\$852.65	\$868.00	7.01	\$228.00	7.01	\$228.00	\$1,096.00
41	1 1/4" Flex Conduit	5	L.F.	\$1.05	\$5.34	0.11	\$3.71	0.57	\$18.55	\$23.90
42	1 1/4" Flex Connector	2	EA	\$6.25	\$12.73	0.20	\$6.51	0.40	\$13.02	\$25.74
43	100amp switch in Panel	1	EA	\$525.45	\$534.91	2.00	\$65.09	2.00	\$65.09	\$600.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
44	New 1500kva Trans.	1	EA	\$19,902.0	\$20,260.24	118.04	\$3,841.78	118.04	\$3,841.78	\$24,102.01
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
45	Disposal of existing trans.	1	EA	\$2,946.95	\$3,000.00	30.72	\$1,000.00	30.72	\$1,000.00	\$3,999.99
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
<del>                                     </del>			<b></b>		\$0.00		\$0.00	0.00	\$0.00	\$0.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
$\vdash$					\$0.00		\$0.00	0.00	\$0.00	\$0.00
$\vdash$					\$0.00		\$0.00	0.00	\$0.00	\$0.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00

Subtotals:

\$37,247.02

565.48 \$18,404.71 \$55,651.73

Sales Tax:

0% \$0.00

 Overhead:
 10%
 \$5,565.17

 Profit:
 10%
 \$6,121.69

Subtotal:

\$67,338.59

Bond: Contingency:

0%	\$0.00
10%	\$6,733.86

**Grand Total:** 

\$74,072.45

Project Name:	COE FLW THERMAL STORAGE
Project Number:	930073-0017 ALTERNATIVE IT-2
Date:	August 02, 1995
Prepared By:	GRH
Sheet:	PAGE 1
Department:	MECHANICAL-HVAC

Base Labor Rate:	
City Multiplier:	0%
Effective Labor Rate:	\$50.00

## **ESTIMATE OF CONSTRUCTION COST**

ITEM		MATE	RIAL		MATERIAL/ LABOR				
# DESCRIPTION	QTY.	UNIT	COST/UNIT	TOTAL	RS/UNI	OST/UNI	TOTAL HRS	TOTAL COST	TOTAL
ICE HARVESTOR	4000	TONS-HRS	\$44.00	\$176,000.00			to the Helphilips		\$176,000.00
CLG TWR (900 TONS)	900	EA	\$40.00	\$36,000.00	120.00	- \$6.25	- I Hardy	\$5,625.00	\$41,625.00
HOISTING	1	LS							\$8,000.00
ICE MACHINE 450 TONS	450	TON	\$375.00	\$168,750.00	100.00	\$105.00		\$47,250.00	\$216,000.00
NIGHT CHILLER 450 TO	450	TON	\$180.00	\$81,000.00	100.00	\$105.00	143.43.4 <u>.4.1</u> .1	\$47,250.00	\$128,250.00
							the state of the s		
CHILLED WTR SYSTEM						.5.KOMPT			
PUMPS 1440 GPM	1	EA	\$3,803.00	\$3,803.00	18.00	\$900.00		\$900.00	\$4,703.00
			#245.00	00.070.00	6.22	60// 50	un i papa i i i	£1.500.00	£2 660.00
8" BUTTERFLY VALVES	6	EA	\$345.00	\$2,070.00	5.33	\$266.50		\$1,599.00	\$3,669.00 \$91.00
THERMOMETERS	2	EA	\$33.00	\$66.00	0.25	\$12.50	The Company of the Co	\$25.00	
PRESSURE GAGES	2	EA	\$16.50	\$33.00	0.25	\$12.50		\$25.00	\$58.00
RELIEF VALVES	1	EA	\$79.00	\$79.00	0.33	\$16.65		\$16.65	\$95.65
1" BALL VALVES	8	EA	\$12.20	\$97.60	0.42	\$21.05		\$168.40	\$266.00
GAGE COCKS	5	EA	\$12.20	\$61.00	0.42	\$21.05		\$105.25	\$166.25
8" AIR SEPARATOR	1	EA	\$2,525.00	\$2,525.00	8.00	\$400.00		\$400.00	\$2,925.00
FLEXIBLE CONNECTOR	2	EA	\$232.00	<b>\$4</b> 64.00	4.00	\$200.00	We Lyridal hatel	\$400.00	\$864.00
CHEMICAL POT FEEDER	1	LS							\$2,000.00
8" PIPING	400	LF	\$42.50	\$17,000.00	1.26	\$63.15	out had	\$25,260.00	\$42,260.00
2" PIPING	100	LF	\$5.30	\$530.00	0.12	\$5.90		\$590.00	\$1,120.00
3/4" PIPING	50	LF	\$2.08	\$104.00	0.11	\$5.40		\$270.00	\$374.00
8" INSULATION	400	LF	\$2.23	\$892.00	0.16	\$8.00		\$3,200.00	\$4,092.00
2" INSULATION	100	LF	\$0.80	\$80.00	0.08	\$4.00		\$400.00	\$480.00
3/4" INSULATION	50	LF	\$0.28	\$14.00	0.07	\$3.50		\$175.00	\$189.00
							e e e e e e e e e e e e e e e e e e e		41 011 00
150 GAL EXP TANK	1	EA	\$845.00	\$845.00	4.00	\$200.00		\$200.00	\$1,045.00
FILL VALVE ASSEMBLY	1	EA	\$113.00	\$113.00	0.42	\$21.05		\$21.05	\$134.05
MANUAL AIR VENT	1	EA	\$35.00	\$35.00	0.67	\$33.35	herte par	\$33.35	\$68.35
1" STRAINER	1	EA	\$13.75	\$13.75	0.47	\$23.55	1 1 18 % %	\$23.55	\$37.30
TRIPLE DUTY VALVE	1	EA	\$1,338.00	\$1,338.00	8.00	\$400.00		\$400.00	\$1,738.00
SUCTION DIFFUSER	1	EA	\$1,205.00	\$1,205.00	6.00	\$300.00	711	\$300.00	\$1,505.00

Subtotals:

\$493,118.35

Sales Tax:

\$0.00

0.00 \$134,637.25 \$637,755.60

Overhead: 10% \$63,775.56 **Profit:** 10% \$70,153.12

Subtotal:

\$771,684.28

\$0.00

\$115,752.64

Bond: Contingen 15%

\$887,436.92

Grand Total:

Project Name:	COE FLW THERMAL STORAGE
Project Number:	930073-0017 ALTERNATIVE IT-2
Date:	August 02, 1995
Prepared By:	GRH
Sheet:	PAGE 2
Department:	MECHANICAL-HVAC

Base Labor Rate:	
City Multiplier:	0%
Effective Labor Rate:	\$50.00

## **ESTIMATE OF CONSTRUCTION COST**

	ITEM	MATERI	IAL		MATERIAL/ LABOR					
#	DESCRIPTION	QTY.	UNIT	COST/UNIT	TOTAL	HRS/UNIT	COST/UNIT	TOTAL HRS	TOTAL COST	TOTAL
									Tallet a. P.	
	CONDENSER WTR SYS						and water than	Mar complete	Comment of the second	
	PUMPS 2160 GPM	1	EA	\$5,943.00	\$5,943.00	24.00	\$1,200.00		\$1,200.00	\$7,143.00
	GRISWOLD SEPARATOR	1	EA	\$5,850.00	\$5,850.00	8.00	\$400.00	u ježine jezikovina	\$400.00	\$6,250.00
	10" BUTTERFLY VALVE	6	EA	\$425.00	\$2,550.00	6.00	\$300.00		\$1,800.00	\$4,350.00
	PRESSURE GAGES	3	EA	\$16.50	\$49.50	0.25	\$12.50		\$37.50	\$87.00
	BALANCING VALVES	1	EA	\$56.00	\$56.00	0.44	\$22.20		\$22.20	\$78.20
	AUTO PURGE VALVE	1	EA	\$1,050.00	\$1,050.00	0.73	\$36.35	rasioakteiti	\$36.35	\$1,086.35
	1"BALL VALVES	6	EA	\$12.20	\$73.20	0.42	\$21.05		\$126.30	\$199.50
	FLEXIBLE CONNECTOR	3	EA	\$340.00	\$1,020.00	4.50 .	\$225.00	- Springlanding	\$675.00	\$1,695.00
	1-1/2" STRAINERS	2	EA	\$47.00	\$94.00	0.57	\$28.55		\$57.10	\$151.10
╁	THERMOMETERS	2	EA	\$33.00	\$66.00	0.25	\$12.50		\$25.00	\$91.00
	GAGE COCKS	7	EA	\$12.20	\$85.40	0.42	\$21.05		\$147.35	\$232.75
_	10" PIPING	400	LF	\$73.00	\$29,200.00	1.50	\$75.00		\$30,000.00	\$59,200.00
$\vdash$	3" PIPING	50	LF	\$6.60	\$330.00	0.37	\$18.60		\$930.00	\$1,260.00
_	2" VENT PIPING	10	LF	\$4.12	\$41.20	0.26	\$13.10		\$131.00	\$172.20
-	1" DRAIN PIPING	15	LF	\$2.18	\$32.70	0.15	\$7.55		\$113.25	\$145.95
	1-1/2" BALL VALVES	3	EA	\$18.05	\$54.15	0.62	\$30.75		\$92.25	\$146.40
_	CHEM FEED PUMP/TAN	1	LS					i pulli au Inesi		\$2,000.00
	SOLENOID VALVE	1	EA	\$410.00	\$410.00	0.75	\$37.50		\$37.50	\$447.50
-	3" BUTTERFLY VALVES	2	EA	\$185.00	\$370.00	2.00	\$100.00		\$200.00	\$570.00
		-	1		Server Will				ingtonete	1 11 11 11 11 11
$\vdash$	TRIPLE DUTY VALVE	1	EA	\$1,338.00	\$1,338.00	6.00	\$300.00	. With the second	\$300.00	\$1,638.00
-	SUCTION DIFFUSER	1	EA	\$1,205.00	\$1,205.00	5.00	\$250.00		\$250.00	\$1,455.00
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Subtotals: \$49,818.15 \$36,580.80 \$88,398.95

Sales Tax: | \$0.00 | Overhead: 10% \$8,839.90

**Profit:** 10% \$8,839.90

Subtotal: \$106,078.74

Bond: \$0.00 Contingency: 15% \$15,911.81

**Grand Total:** \$121,990.55

Project Name:	COE FLW THERMAL STORAGE
Project Number:	930073-0017 ALTERNATIVE IT-2
Date:	August 02, 1995
Prepared By:	GRH
Sheet:	PAGE 3
Department:	MECHANICAL-HVAC

Base Labor Rate:	
City Multiplier:	0%
Effective Labor Rate:	\$50.00

## **ESTIMATE OF CONSTRUCTION COST**

ITEM		MATERL	AL		MATERIAL/ LABOR				
# DESCRIPTION	QTY.	UNIT	COST/UNIT	TOTAL	HRS/UNIT	COST/UNIT	TOTAL HRS	TOTAL COST	TOTAL
PROJ MAN/MISC COSTS	1	LS		\$0.00		\$0.00	0.00	\$0.00	\$39,900.00
				2000				indfigually.com	
SIESMIC	1	LS		\$0.00		\$0.00	⇒0.00	\$0.00	\$10,000.00
							gage exercises the state		A STATE OF THE STA
CONTROLS	1	LS		\$0.00		\$0.00	0.00	\$0.00	\$90,000.00
				e see 1					Jan Perligi
BALANCING	1	LS		\$0.00		\$0.00	0.00	\$0.00	\$4,000.00
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	1					. April et jare	J. J. N. S.		
						adel Angels e			grafije sa katerior
	1							er áð tiðfræður mill. Er eighjað í reiði	1. J. 1880 (1. 1881)
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H		1					Charte Colonia		
	1	<b>—</b>				"我就是没有		11:53:57.25	
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							HEATS SHOTS	HANDLE MARK	and the first of the second

\$0.00 Subtotals:

\$143,900.00 0.00 \$0.00

Sales Tax: \$0.00

\$14,390.00 Overhead: 10% **Profit:** 10% \$14,390.00

Subtotal:

\$172,680.00

\$0.00

Bond: 15% \$25,902.00 Contingency:

**Grand Total:** 

\$198,582.00

Project Name:	Ft. Leonardwood Chiller Study - Alt. IT-2
Project Number:	930073-0017
Date:	August 17, 1995
Prepared By:	S. Benway
Sheet:	1 of 2
Department:	Electrical

Base Labor Rate:	\$28.50
City Multiplier (Labor):	114%
Effective Labor Rate:	\$32.55

City Multiplier (Material):	102%

# ESTIMATE OF CONSTRUCTION COST

	ITEM		MATE	RIAL		MATERIAL/ LABOR				
#	DESCRIPTION	QTY.	UNIT	COST/UNIT	TOTAL	RS/UNI	COST/UNIT	TOTAL HRS	TOTAL COST	TOTAL
	Chiller #1 Replacement				\$0.00		\$0.00	0.00	\$0.00	\$0.00
1	Demolition	1	LOT	n/a	\$0.00	86.64	\$2,820.00	86.64	\$2,820.00	\$2,820.00
2	Shld., 5kv, #3/0, cu. wire	180	L.F.	\$2.75	\$504.00	0.04	\$1.43	7.90	\$257.00	\$761.00
3	Cable Termination	12	EA	\$98.23	\$1,200.00	1.23	\$40.00	14.75	\$480.00	\$1,680.01
4	Grounding	1	LOT	n/a	\$0.00	6.15	\$200.00	6.15	\$200.00	\$200.00
5	2 1/2" Rigid Conduit	40	L.F.	\$5.60	\$228.00	0.18	\$5.70	7.01	\$228.00	\$456.00
	2 1/2" Rigid Connector	6	EA ·	\$7.86	\$48.00	1.23	\$40.00	7.37	\$240.00	\$288.00
	2 1/2" Conduit Hanger	4	EA	\$9.82	\$40.00	0.61	\$20.00	2.46	\$80.00	\$120.00
	2 1/2" Flex Conduit	5	L.F.	\$2.16	\$11.00	0.23	\$7.60	1.17	\$38.00	\$49.00
9	2 1/2" Flex Connector	2	EA	\$23.58	\$48.00	0.35	\$11.50	0.71	\$23.00	\$71.00
	5kv Fuse	3	EA	\$294.70	\$900.00	4.82	\$157.00	14.47	\$471.00	\$1,371.00
	2" Elbow	2	EA	\$22.60	\$46.00	0.88	\$28.50	1.75	\$57.00	\$103.00
	Connection to Equipment	1	LOT	n/a	\$0.00	7.99	\$260.00	7.99	\$260.00	\$260.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
	Chiller #2 Replacement				\$0.00		\$0.00	0.00	\$0.00	\$0.00
13	Demolition	1	LOT	n/a	\$0.00	86.64	\$2,820.00	86.64	\$2,820.00	\$2,820.00
	Shielded, 5kv, #3/0, cu. w	180	L.F.	\$2.75	\$504.00	0.04	\$1.43	7.90	\$257.00	\$761.00
	Cable Termination	12	EA	\$98.23	\$1,200.00	1.23	\$40.00	14.75	\$480.00	\$1,680.01
	Grounding	1	LOT	n/a	\$0.00	6.15	\$200.00	6.15	\$200.00	\$200.00
	2 1/2" Rigid Conduit	40	L.F.	\$5.60	\$228.00	0.18	\$5.70	7.01	\$228.00	\$456.00
	2 1/2" Rigid Connector	6	EA	\$7.86	\$48.00	1.23	\$40.00	7.37	\$240.00	\$288.00
	2 1/2" Conduit Hanger	4	EA	\$9.82	\$40.00	0.61	\$20.00	2.46	\$80.00	\$120.00
	2 1/2" Flex Conduit	5	L.F.	\$2.16	\$11.00	0.23	\$7.60	1.17	\$38.00	\$49.00
	2 1/2" Flex Connector	2	EA	\$23.58	\$48.00	0.35	\$11.50	0.71	\$23.00	\$71.00
	5kv Fuse	3	EA	\$294.70	\$900.00	4.82	\$157.00	14.47	\$471.00	\$1,371.00
	2" Elbow	2	EA	\$22.60	\$46.00	0.88	\$28.50	1.75	\$57.00	\$103.00
	Connection to Equipment	1	LOT	n/a	\$0.00	7.99	\$260.00	7.99	\$260.00	\$260.00
	1 1				\$0.00		\$0.00	0.00	\$0.00	\$0.00
	Chilled Water Pump-40hp				\$0.00		\$0.00	0.00	\$0.00	\$0.00
25	#1/0 thwn cu. conductor	150	L.F.	\$1.14	\$173.40	0.02	\$0.65	3.00	\$97.64	\$271.04
		40	L.F.	\$1.21	\$49.27	0.08	\$2.60	3.20	\$104.15	\$153.42
	150amp fuse	3	EA	\$29.00	\$88.57	0.20	\$6.51	0.60	\$19.53	\$108.09
-	Connection to Equipment	1	EA	\$20.00	\$20.36	4.00	\$130.19	4.00	\$130.19	\$150.55
	Combo. Starter/Disc.	1			\$1,385.00	10.60	\$345.00	10.60	\$345.00	\$1,730.00
	1 1/4" Flex Conduit	5	L.F.	\$1.07	\$5.45	0.11	\$3.71	0.57	\$18.55	\$24.00
	1 1/4" Flex Connector	2	EA	\$6.38	\$12.98	0.20	\$6.51	0.40	\$13.02	\$26.00
	150amp switch in Panel	1	EA	\$918.38	\$934.91	2.00	\$65.09	2.00	\$65.09	\$1,000.00
1				†	\$0.00	1	\$0.00	0.00	\$0.00	\$0.00
$\vdash$					\$0.00		\$0.00	0.00	\$0.00	\$0.00
-		-		<del> </del>	\$0.00		\$0.00	0.00	\$0.00	\$0.00
-			<b>†</b>	<b></b>	\$0.00		\$0.00	0.00	\$0.00	\$0.00
$\vdash$				<del>                                     </del>	\$0.00		\$0.00	0.00	\$0.00	\$0.00
			1	<del>                                     </del>	\$0.00		\$0.00	0.00	\$0.00	\$0.00

Project Name:	Ft. Leonardwood Chiller Study			
Project Number:	930073-0017			
Date:	August 17, 1995			
Prepared By:	S. Benway			
Sheet:	2 of 2			
Department:	Electrical			

Base Labor Rate:	\$28.50
City Multiplier (Labor):	114%
Effective Labor Rate:	\$32.55

City Multiplier (Material):	102%
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## **ESTIMATE OF CONSTRUCTION COST**

ITEM			MATERIAL		LABOR				MATERIAL/ LABOR	
#	DESCRIPTION	QTY.	UNIT	COST/UNIT	TOTAL	RS/UNI	COST/UNIT	TOTAL HRS	TOTAL COST	TOTAL
	Cooling Tower Fan-60hp				\$0.00		\$0.00	0.00	\$0.00	\$0.00
33	#2/0 thwn cu. conductor	150	L.F.	\$1.17	\$178.66	0.03	\$0.98	4.50	\$146.46	\$325.12
34	2" EMT conduit	40	L.F.	\$1.91	\$77.78	0.10	\$3.25	4.00	\$130.19	\$207.96
35	200amp fuse	3	EA	\$22.50	\$68.72	0.22	\$7.23	0.67	\$21.68	\$90.39
36	Connection to Equipment	1	EA	\$300.00	\$305.40	20.00	\$650.94	20.00	\$650.94	\$956.34
37	Combo. Starter/Disc.	1	EA	\$1,943.67	\$1,978.66	16.00	\$520.75	16.00	\$520.75	\$2,499.41
38	2" Flex Conduit	5	L.F.	\$1.80	\$9.16	0.20	\$6.51	1.00	\$32.55	\$41.71
39	2" Flex Connector	2	EA	\$12.30	\$25.04	0.35	\$11.33	0.70	\$22.65	\$47.70
40	200amp switch in Panel	1	EA	\$1,000.00	\$1,018.00	8.00	\$260.38	8.00	\$260.38	\$1,278.38
					\$0.00	,	\$0.00	0.00	\$0.00	\$0.00
	Cond. Water Pump-25hp				\$0.00		\$0.00	0.00	\$0.00	\$0.00
41	#4 thwn cu. conductor	180	L.F.	\$0.39	\$71.46	0.02	\$0.65	3.60	\$117.17	\$188.63
42	1 1/4" EMT conduit	50	L.F.	\$1.21	\$61.59	0.08	\$2.60	4.00	\$130.19	\$191.78
43	90amp fuse	3	EA	\$10.15	\$31.00	0.20	\$6.51	0.60	\$19.53	\$50.53
44	Connection to Equipment	1	EA	\$30.00	\$30.54	4.09	\$133.17	4.09	\$133.17	\$163.71
45	Combo. Starter/Disc.	1	EA	\$1,356.58	\$1,381.00	10.60	\$345.00	10.60	\$345.00	\$1,726.00
46	1 1/4" Flex Conduit	5	L.F.	\$1.07	\$5.45	0.11	\$3.58	0.55	\$17.90	\$23.35
47	1 1/4" Flex Connector	2	EA	\$6.38	\$12.99	0.20	\$6.51	0.40	\$13.02	\$26.01
48	100amp switch in Panel	1	EA	\$918.38	\$934.91	2.00	\$65.09	2.00	\$65.09	\$1,000.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
49	New 1500kva Transforme	1	EA	\$19,902.0	\$20,260.24	118.04	\$3,841.78	118.04	\$3,841.78	\$24,102.01
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
50	Disposal of existing trans.	1	EA	\$2,946.95	\$3,000.00	30.72	\$1,000.00	30.72	\$1,000.00	\$3,999.99
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00

Subtotals:

\$38,170.52

570.55 \$18,569.60 \$56,740.12

Sales Tax: 0% \$0.00

 Overhead:
 10%
 \$5,674.01

 Profit:
 10%
 \$6,241.41

Subtotal:

\$68,655.55

Bond: Contingency:

 0%
 \$0.00

 10%
 \$6,865.55

**Grand Total:** 

\$75,521.10

Project Name:	COE FLW THERMAL STORAGE	
Project Number:	930073-0017 ALTERNATIVE IT-3	
Date:	August 02, 1995	
Prepared By:	GRH	
Sheet:	PAGE 1	
Department:	MECHANICAL-HVAC	

Base Labor Rate:	
City Multiplier:	0%
Effective Labor Rate:	\$50.00

## **ESTIMATE OF CONSTRUCTION COST**

ITEM				MATER	IAL	LABOR				MATERIAL/ LABOR
#	DESCRIPTION	QTY.	UNIT	COST/UNIT	TOTAL	HRS/UNIT	COST/UNIT	TOTAL HRS	TOTAL COST	TOTAL
	ICE TANK	6000	TONS-HRS	\$44.00	\$264,000.00					\$264,000.00
$\vdash$	CLG TWR-1215 TONS	1215	EA	\$40.00	\$48,600.00	110.00	\$5.00	ermyky ityjst	\$6,075.00	\$54,675.00
	HOISTING	1	LS				santiri Ala	i dişabir O	MANA MANA	\$8,000.00
	ICE MACHINE 815 TONS	815	TON	\$375.00	\$305,625.00	100.00	\$80.00		\$65,200.00	\$370,825.00
$\vdash$	NIGHT CHILLER 400 TO	400	TON	\$180.00	\$72,000.00	100.00	\$100.00		\$40,000.00	\$112,000.00
					Mar W		Gerrina.		.vijast lietule	
$\vdash$	CHILLED WTR SYSTEM							Privation 4	A fine partie of the first	
	PUMPS 1440 GPM	1	EA	\$3,803.00	\$3,803.00	18.00	\$900.00		\$900.00	\$4,703.00
					100000000000000000000000000000000000000					
$\vdash$	8" BUTTERFLY VALVES	6	EA	\$345.00	\$2,070.00	5.33 .	\$266.50		\$1,599.00	\$3,669.00
$\vdash$	THERMOMETERS	2	EA	\$33.00	\$66.00	0.25	\$12.50		\$25.00	\$91.00
	PRESSURE GAGES	2	EA	\$16.50	\$33.00	0.25	\$12.50		\$25,00	\$58.00
	RELIEF VALVES	ī	EA	\$79.00	\$79.00	0.33	\$16.65	djest brig	\$16.65	\$95.65
-	1" BALL VALVES	8	EA	\$12.20	\$97.60	0.42	\$21.05		\$168.40	\$266.00
	GAGE COCKS	5	EA	\$12.20	\$61.00	0.42	\$21.05		\$105.25	\$166.25
	8" AIR SEPARATOR	1	EA	\$2,525.00	\$2,525.00	8.00	\$400.00	e elektrist ja	\$400.00	\$2,925.00
	FLEXIBLE CONNECTOR	2	EA	\$232.00	\$464.00	4.00	\$200.00		\$400.00	\$864.00
$\vdash$	CHEMICAL POT FEEDER	ı	LS	-	5.李军主义表示		aleta ett.			\$2,000.00
	8" PIPING	400	LF	\$42.50	\$17,000.00	1.26	\$63.15		\$25,260.00	\$42,260.00
$\vdash$	2" PIPING	100	LF	\$5.30	\$530.00	0.12	\$5.90	HANNET	\$590.00	\$1,120.00
$\vdash$	3/4" PIPING	50	LF	\$2.08	\$104.00	0.11	\$5.40	Er Puzzi.	\$270.00	\$374.00
$\vdash$	8" INSULATION	400	LF	\$2.23	\$892.00	0.16	\$8.00		\$3,200.00	\$4,092.00
	2" INSULATION	100	LF	\$0.80	\$80.00	0.08	\$4.00		\$400.00	\$480.00
	3/4" INSULATION	50	LF	\$0.28	\$14.00	0.07	\$3.50		<b>\$</b> 175.00	\$189.00
		-			\$0.00		straints	riki tah		
	150 GAL EXP TANK	1	EA	\$845.00	\$845.00	4.00	\$200.00		\$200.00	\$1,045.00
$\vdash$	FILL VALVE ASSEMBLY	1	EA	\$113.00	\$113.00	0.42	\$21.05		\$21.05	\$134.05
	MANUAL AIR VENT	ī	EA	\$35.00	\$35.00	0.67	\$33.35	rytherigh.	\$33.35	\$68.35
	1" STRAINER	1	EA	\$13.75	\$13.75	0.47	\$23.55	er Perg Page	\$23.55	\$37.30
	TRIPLE DUTY VALVE	1	EA	\$1,338.00	\$1,338.00	6.00	\$300.00	Marin Marin	\$300.00	\$1,638.00
	SUCTION DIFFUSER	1	EA	\$1,053.00	\$1,053.00	4.00	\$200.00		\$200.00	\$1,253.00

Subtotals:

\$721,441.35

\$145,587.25 | \$877,028.60

Sales Tax:

\$0.00

 Overhead:
 10%
 \$87,702.86

 Profit:
 10%
 \$96,473.15

Subtotal:

\$1,061,204.61

Bond: Contingen \$0.00 15% \$159,180.69

**Grand Total:** 

\$1,220,385.30

COE FLW THERMAL STORAGE	
930073-0017 ALTERNATE IT-3	
August 02, 1995	
GRH	
PAGE 2	
MECHANICAL-HVAC	
	930073-0017 ALTERNATE IT-3 August 02, 1995 GRH PAGE 2

Base Labor Rate:	
City Multiplier:	0%
Effective Labor Rate:	\$50.00

# ESTIMATE OF CONSTRUCTION COST

ITEM			MATERIAL			MATERIAL/ LABOR				
#	DESCRIPTION	QTY.	UNIT	COST/UNIT	TOTAL	HRS/UNIT	COST/UNIT	TOTAL HRS	TOTAL COST	TOTAL
									a dayah daya	
	CONDENSER WTR SYS						atifia equita			g Sugardi
	PUMPS 2916 GPM	1	EA	\$5,943.00	\$5,943.00	18.00	\$1,200.00		\$1,200.00	\$7,143.00
	GRISWOLD SEPARATOR	1	EA	\$4,750.00	\$4,750.00	8.00	\$400.00		\$400.00	\$5,150.00
	8" BUTTERFLY VALVES	6	EA	\$345.00	\$2,070.00	5.33	\$266.50		\$1,599.00	\$3,669.00
	PRESSURE GAGES	3	EA	\$16.50	\$49.50	0.25	\$12.50		\$37.50	\$87.00
	BALANCING VALVES	1	EA	\$56.00	\$56.00	0.44	\$22.20		\$22.20	\$78.20
-	AUTO PURGE VALVE	1	EA	\$1,050.00	\$1,050.00	0.73	\$36.35		\$36.35	\$1,086.35
	1"BALL VALVES	6	EA	\$12.20	\$73.20	0.42	\$21.05	de la constitución	\$126.30	\$199.50
	FLEXIBLE CONNECTOR	3	EA	\$340.00	\$1,020.00	4.50 .	\$225.00	Matter With the	\$675.00	\$1,695.00
	1-1/2" STRAINERS	2	EA	\$47.00	\$94.00	0.57	\$28.55		\$57.10	\$151.10
	THERMOMETERS	2	EA	\$33.00	\$66.00	0.25	\$12.50	a Walso Flancis.	\$25.00	\$91.00
	GAGE COCKS	7	EA	\$12.20	\$85.40	0.42	\$21.05		\$147.35	\$232.75
-	8" PIPING	400	LF	\$42.50	\$17,000.00	1.26	\$63.15	. H. M. G. S. M. G. S	\$25,260.00	\$42,260.00
	3" PIPING	50	LF	\$6.60	\$330.00	0.37	\$18.60		\$930.00	\$1,260.00
	2" VENT PIPING	10	LF	\$4.12	\$41.20	0.26	\$13.10	Japan Japan Japan	\$131.00	\$172.20
	1" DRAIN PIPING	15	LF	\$2.18	\$32.70	0.15	\$7.55	Tarjuda Sh	\$113.25	\$145.95
	1-1/2" BALL VALVES	3	EA	\$18.05	\$54.15	0.62	\$30.75		\$92.25	\$146.40
	CHEM FEED PUMP/TAN	1	LS						. Pari - misse	\$2,000.00
	SOLENOID VALVE	1	EA	\$410.00	\$410.00	0.75	\$37.50	dia pytalica a	\$37.50	\$447.50
	3" BUTTERFLY VALVES	2	EA	\$185.00	\$370.00	2.00	\$100.00		\$200.00	\$570.00
					Arrigat Basic		atehn ga			
	TRIPLE DUTY VALVE	1	EA	\$1,338.00	\$1,338.00	6.00	\$300.00	1 4 - 31 14	\$300.00	\$1,638.00
	SUCTION DIFFUSER	1	EA	\$1,205.00	\$1,205.00	5.00	\$250.00		\$250.00	\$1,455.00
								Agi arenda		
		-			geresey.					
-					2005 CH				mat Pigeti	
$\vdash$			1		13/3A.11 /42					
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$\vdash$					Heron Grand			Thele in plant from the		
$\vdash$							A-17-17 E. 1	Maria Baran		

Subtotals:

\$36,038.15

\$31,639.80 \$69,677.95

Sales Tax:

\$0.00

Overhead: Profit:

10% \$6,967.80 \$6,967.80 10%

Subtotal:

\$83,613.54

Bond: Contingency:

\$0.00 15% \$12,542.03

**Grand Total:** 

\$96,155.57

L Tojece Pitalie.	COE FLW THERMAL STORAGE
Project Number:	930073-0017 ALTERNATIVE IT-3
Date:	August 02, 1995
Prepared By:	GRH
	PAGE 3
Department:	MECHANICAL-HVAC

Base Labor Rate:	
City Multiplier:	0%
Effective Labor Rate:	\$50.00

## **ESTIMATE OF CONSTRUCTION COST**

ІТЕМ			MATERIAL		LABOR				MATERIAL/ LABOR
# DESCRIPTION	QTY.	UNIT	COST/UNIT	TOTAL	HRS/UNIT	COST/UNIT	TOTAL HRS	TOTAL COST	TOTAL
PROJ MAN. /MISC COSTS	1	LS		\$0.00		\$0.00	0.00	\$0.00	\$29,000.00
						Private 1989			
SIESMIC CONTROLS	1	LS		\$0.00		\$0,00	0.00	\$0.00	\$10,000.00
	1	LS		\$0.00		\$0.00	0.00	\$0.00	\$120,000.00
CONTROLS	1	LS			ļ	\$0.00	0.00	\$0.00	\$120,000.00
BALANCING	1	LS		\$0.00		\$0.00	0.00	\$0.00	\$4,000.00
BALANCING	1	LO		\$0.00		\$0.00 (	A.44 A.17 A.44	<b>30.00</b>	194,000.00
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Subtotals: \$0.00 \$163,000.00

 Sales Tax:
 \$0.00
 Overhead:
 10%
 \$16,300.00

 Profit:
 10%
 \$16,300.00

Subtotal: \$195,600.00

**Bond:** \$0.00 **Contingency:** 15% \$29,340.00

**Grand Total:** \$224,940.00

Project Name:	Ft. Leonardwood Chiller Study - Alt. IT-3
Project Number:	930073-0017
Date:	August 17, 1995
Prepared By:	S. Benway
Sheet:	1 of 2
Department:	Electrical

Base Labor Rate:	\$28.50
City Multiplier (Labor):	114%
Effective Labor Rate:	\$32.55

City Multiplier	(Matarial):	1 102%
City Multiplier	(Material):	102/0

# ESTIMATE OF CONSTRUCTION COST

ITEM			MATE	RIAL	LABOR				MATERIAL/ LABOR	
#	DESCRIPTION	QTY.	UNIT	COST/UNIT	TOTAL	RS/UNI	COST/UNIT	TOTAL HRS	TOTAL COST	TOTAL
	Chiller #1 Replacement				\$0.00		\$0.00	0.00	\$0.00	\$0.00
1	Demolition	1	LOT	n/a	\$0.00	86.64	\$2,820.00	86.64	\$2,820.00	\$2,820.00
2	Shielded, 5kv, #4/0, cu. w	180	L.F.	\$3.10	\$568.04	0.15	\$4.88	27.00	\$878.77	\$1,446.81
3	Cable Termination	12	EA	\$98.23	\$1,200.00	1.23	\$40.00	14.75	\$480.00	\$1,680.01
4	Grounding	1	LOT	n/a	\$0.00	6.15	\$200.00	6.15	\$200.00	\$200.00
5	2 1/2" Rigid Conduit	40	L.F.	\$5.60	\$228.00	0.18	\$5.70	7.01	\$228.00	\$456.00
6	2 1/2" Rigid Connector	6	EA	\$7.86	\$48.00	1.23	\$40.00	7.37	\$240.00	\$288.00
7	2 1/2" Conduit Hanger	4	EA	\$9.82	\$40.00	0.61	\$20.00	2.46	\$80.00	\$120.00
8	2 1/2" Flex Conduit	5	L.F.	\$2.16	\$11.00	0.23	\$7.60	1.17	\$38.00	\$49.00
9	2 1/2" Flex Connector	2	EA	\$23.58	\$48.00	0.35	\$11.50	0.71	\$23.00	\$71.00
10	5kv Fuse	3	EA	\$294.70	\$900.00	4.82	\$157.00	14.47	\$471.00	\$1,371.00
11	2" Elbow	2	EA	\$22.60	\$46.00	0.88	\$28.50	1.75	\$57.00	\$103.00
12	Connection to Equipment	1	EA	\$500.00	\$509.00	20.00	\$650.94	20.00	\$650.94	\$1,159.94
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
	Chiller #2 Replacement				\$0.00		\$0.00	0.00	\$0.00	\$0.00
13	Demolition	1	LOT	n/a	\$0.00	86.64	\$2,820.00	86.64	\$2,820.00	\$2,820.00
	Shielded, 5kv, #3/0, cu. w	180	L.F.	\$2.75	\$504.00	0.04	\$1.43	7.90	\$257.00	\$761.00
	Cable Termination	12	EA	\$98.23	\$1,200.00	1.23	\$40.00	14.75	\$480.00	\$1,680.01
	Grounding	1	LOT	n/a	\$0.00	6.15	\$200.00	6.15	\$200.00	\$200.00
	2 1/2" Rigid Conduit	40	L.F.	\$5.60	\$228.00	0.18	\$5.70	7.01	\$228.00	\$456.00
	2 1/2" Rigid Connector	6	EA	\$7.86	\$48.00	1.23	\$40.00	7.37	\$240.00	\$288.00
	2 1/2" Conduit Hanger	4	EA	\$9.82	\$40.00	0.61	\$20.00	2.46	\$80.00	\$120.00
	2 1/2" Flex Conduit	5	L.F.	\$2.16	\$11.00	0.23	\$7.60	1.17	\$38.00	\$49.00
	2 1/2" Flex Connector	2	EA	\$23.58	\$48.00	0.35	\$11.50	0.71	\$23.00	\$71.00
	5kv Fuse	3	EA	\$294.70	\$900.00	4.82	\$157.00	14.47	\$471.00	\$1,371.00
	2" Elbow	2	EA	\$22.60	\$46.00	0.88	\$28.50	1.75	\$57.00	\$103.00
	Connection to Equipment	1	LOT	n/a	\$0.00	7.99	\$260.00	7.99	\$260.00	\$260.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
$\vdash$	Chilled Water Pump-40hp				\$0.00		\$0.00	0.00	\$0.00	\$0.00
25	#1/0 thwn cu. conductor	150	L.F.	\$1.14	\$173.40	0.02	\$0.65	3.00	\$97.64	\$271.04
	1 1/4" EMT conduit	40	L.F.	\$1.21	\$49.27	0.08	\$2.60	3.20	\$104.15	\$153.42
27	150amp fuse	3	EA	\$29.00	\$88.57	0.20	\$6.51	0.60	\$19.53	\$108.09
_	Connection to Equipment	1	EA	\$20.00	\$20.36	4.00	\$130.19	4.00	\$130.19	\$150.55
	Combo. Starter/Disc.	1	EA	\$1,360.51	\$1,385.00	10.60	\$345.00	10.60	\$345.00	\$1,730.00
	1 1/4" Flex Conduit	5	L.F.	\$1.07	\$5.45	0.11	\$3.71	0.57	\$18.55	\$24.00
	1 1/4" Flex Connector	2	EA	\$6.38	\$12.98	0.20	\$6.51	0.40	\$13.02	\$26.00
	150amp switch in Panel	1	EA	\$918.38	\$934.91	2.00	\$65.09	2.00	\$65.09	\$1,000.00
		1			\$0.00		\$0.00	0.00	\$0.00	\$0.00
33	New 1500kva Transforme	1	EA	\$19,902.0	\$20,260.24	118.04	\$3,841.78	118.04	\$3,841.78	\$24,102.01
		1			\$0.00		\$0.00	0.00	\$0.00	\$0.00
34	Disposal of existing trans.	1	EA	\$2,946.95		30.72	\$1,000.00	30.72	\$1,000.00	\$3,999.99
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
3.5	New Primary for Trans.	1	LOT	n/a	\$0.00	460.87	\$15,000.00	460.87	\$15,000.00	\$15,000.00

Project Name:	Ft. Leonardwood Chiller Study					
Project Number:	930073-0017					
Date:	August 17, 1995					
Prepared By:	S. Benway					
Sheet:	2 of 2					
Department:	Electrical					

Base Labor Rate:	\$28.50
City Multiplier (Labor):	114%
Effective Labor Rate:	\$32.55

City Multiplier (Material):	102%
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# **ESTIMATE OF CONSTRUCTION COST**

ІТЕМ			MATERIAL		LABOR				MATERIAL/ LABOR	
#	DESCRIPTION	QTY.	UNIT	COST/UNIT	TOTAL	RS/UNI	COST/UNIT	TOTAL HRS	TOTAL COST	TOTAL
	(2) Cond. Water P20hp				\$0.00		\$0.00	0.00	\$0.00	\$0.00
36	#3 thwn cu. conductor	300	L.F.	\$0.55	\$167.66	0.02	\$0.65	6.00	\$195.28	\$362.95
37	1 1/4" EMT conduit	80	L.F.	\$1.21	\$98.54	0.08	\$2.60	6.40	\$208.30	\$306.84
38	80amp fuse	6	EA	\$10.15	\$62.00	0.20	\$6.51	1.20	\$39.06	\$101.05
39	Connection to Equipment	2	EA	\$20.00	\$40.72	4.00	\$130.19	8.00	\$260.38	\$301.10
40	Combo. Starter/Disc.	2	EA	\$852.65	\$1,736.00	7.01	\$228.00	14.01	\$456.00	\$2,191.99
41	1 1/4" Flex Conduit	10	L.F.	\$1.05	\$10.69	0.11	\$3.71	1.14	\$37.10	\$47.79
42	1 1/4" Flex Connector	4	EA	\$6.25	\$25.45	0.20	\$6.51	0.80	\$26.04	\$51.49
43	100amp switch in Panel	2	EA	\$525.45	\$1,069.82	2.00	\$65.09	4.00	\$130.19	\$1,200.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
	(2) Cooling Twr. Fan-30hr				\$0.00		\$0.00	0.00	\$0.00	\$0.00
44	#2 thwn cu. conductor	300	L.F.	\$0.55	\$167.66	0.02	\$0.65	6.00	\$195.28	\$362.95
45	1 1/4" EMT conduit	80	L.F.	\$1.21	\$98.54	0.08	\$2.60	6.40	\$208.30	\$306.84
46	120amp fuse	6	EA	\$29.00	\$177.13	0.20	\$6.51	1.20	\$39.06	\$216.19
47	Connection to Equipment	2	EA	\$20.00	\$40.72	4.00	\$130.19	8.00	\$260.38	\$301.10
48	Combo. Starter/Disc.	2	EA	\$1,356.58	\$2,762.00	10.60	\$345.00	21.20	\$690.00	\$3,451.99
49	1 1/4" Flex Conduit	10	L.F.	\$1.07	\$10.89	0.11	\$3.71	1.14	\$37.10	\$48.00
50	1 1/4" Flex Connector	4	EA	\$6.38	\$25.96	0.20	\$6.51	0.80	\$26.04	\$52.00
51	100amp switch in Panel	2	EA	\$918.38	\$1,869.82	2.00	\$65.09	4.00	\$130.19	\$2,000.01
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00

**Subtotals:** \$40,916

\$40,916.82

1072.12 \$34,894.34 \$75,811.15

Sales Tax: 0% \$0.00

 Overhead:
 10%
 \$7,581.12

 Profit:
 10%
 \$8,339.23

Subtotal:

\$91,731.50

**Bond:** 0% \$0.00 **Contingency:** 10% \$9,173.15

**Grand Total:** 

\$100,904.65

a roject rante.	COE FLW THERMAL STORAGE
Project Number:	930073-0017 ALTERNATIVE IT-4
Date:	August 02, 1995
Prepared By:	GRH
Sheet:	PAGE 1
Department:	MECHANICAL-HVAC

Base Labor Rate:	
City Multiplier:	0%
Effective Labor Rate:	\$50.00

# **ESTIMATE OF CONSTRUCTION COST**

ITEM		MATERIAL		LABOR				MATERIAL/ LABOR	
# DESCRIPTION	QTY.	UNIT	COST/UNIT	TOTAL	RS/UNI	COST/UNIT	TOTAL HRS	TOTAL COST	TOTAL
ICE TANK	6000	TONS-HRS	\$44.00	\$264,000.00			- eletatur - Li		\$264,000.00
CLG TWR-1085 TONS	1085	TONS	\$40.00	\$43,400.00	0.13	\$6.25	tyu 144 <sub>5</sub> or 1918	\$6,781.25	\$50,181.25
HOISTING				unite gardi desi					\$8,000.00
ICE MACHINE 635 TONS	635	TON	\$375.00	\$238,125.00	100.00	\$85.00	JAME.	\$53,975.00	\$292,100.00
NIGHT CHILLER 450 TO	450	TON	\$180.00	\$81,000.00	100.00	\$115.00		\$51,750.00	\$132,750.00
						er pärkare i.		handreicht.	
CHILLED WTR SYSTEM						e de la companya de l	i gridhe e e	The state of the s	
PUMPS 1440 GPM	1	EA	\$3,803.00	\$3,803.00	18.00	\$900.00	A TORREST	\$900.00	\$4,703.00
							Talka Miljara III.	in sprájta	
8" BUTTERFLY VALVES	6	EA	\$345.00	\$2,070.00	5.33	\$266.50	Stations	\$1,599.00	\$3,669.00
THERMOMETERS	2	EA	\$33.00	\$66.00	0.25	\$12.50		\$25.00	\$91.00
PRESSURE GAGES	2	EA	\$16.50	\$33.00	0.25	\$12.50		\$25.00	\$58.00
RELIEF VALVES	1	EA	\$79.00	\$79.00	0.33	\$16.65	i hrdýtykáni.	\$16.65	\$95.65
1" BALL VALVES	8	EA	\$12.20	\$97.60	0.42	\$21.05		\$168.40	\$266.00
GAGE COCKS	5	EA	\$12.20	\$61.00	0.42	\$21.05		\$105.25	\$166.25
8" AIR SEPARATOR	1	EA	\$2,525.00	\$2,525.00	8.00	\$400.00	Def Agent Lines	\$400.00	\$2,925.00
FLEXIBLE CONNECTOR	2	EA	\$232.00	\$464.00	4.00	\$200.00	veidile (1	\$400.00	\$864.00
CHEMICAL POT FEEDER	. 1	LS		f		. Anti-Autobi	apiti ini		\$2,000.00
8" PIPING	400	LF	\$42.50	\$17,000.00	1.26	\$63.15		\$25,260.00	\$42,260.00
2" PIPING	100	LF	\$5.30	\$530.00	0.12	\$5.90		\$590.00	\$1,120.00
3/4" PIPING	50	LF	\$2.08	\$104.00	0.11	\$5.40	Libration of the	\$270.00	\$374.00
8" INSULATION	400	LF	\$2.23	\$892.00	0.16	\$8.00	the selection of the se	\$3,200.00	\$4,092.00
2" INSULATION	50	LF	\$0.80	\$40.00	0.08	\$4.00	jagete in	\$200.00	\$240.00
3/4" INSULATION	50	LF	\$0.28	\$14.00	0.07	\$3.50		\$175.00	\$189.00
				1.000			1, 1, 1, 1, 1	t dangana a tangan	14.214
150 GAL EXP TANK	1	EA		· 传信://4/15	4.00	\$200.00		\$200.00	\$200.00
FILL VALVE ASSEMBLY	1	EA.	\$113.00	\$113.00	0.42	\$21.05		\$21.05	\$134.05
MANUAL AIR VENT	1	EA	\$35.00	\$35.00	0.67	\$33.35		\$33.35	\$68.35
I" STRAINER	1	EA	\$13.75	\$13.75	0.47	\$23.55		\$23.55	\$37.30
TRIPLE DUTY VALVE	1	EA	\$2,208.00	\$2,208.00	8.00	\$400.00	Partition to	\$400.00	\$2,608.00
SUCTION DIFFUSER	1	EA	\$1,053.00	\$1,053.00	6.00	\$300.00	Harris (A. N. ) . H	\$300.00	\$1,353.00

Subtotals:

\$657,726.35

\$146,818.50 | \$814,544.85

Sales Tax:

\$0.00

 Overhead:
 10%
 \$81,454.49

 Profit:
 10%
 \$89,599.93

Subtotal:

\$985,599.27

Bond: Contingenc \$0.00 15% \$147,839.89

**Grand Total:** 

\$1,133,439.16

Project Name:	COE FLW THERMAL STORAGE
Project Number:	930073-0017 ALTERNATIVE IT-4
Date:	August 02, 1995
Prepared By:	GRH
Sheet:	PAGE 2
Department:	MECHANICAL-HVAC

Base Labor Rate:	
City Multiplier:	0%
Effective Labor Rate:	\$50.00

## **ESTIMATE OF CONSTRUCTION COST**

ITEM		MATERIAL		LABOR				MATERIAL/ LABOR		
#	DESCRIPTION	QTY.	UNIT	COST/UNIT	TOTAL	HRS/UNIT	COST/UNIT	TOTAL HRS	TOTAL COST	TOTAL
							taja digi zarta Ala			
	CONDENSER WTR SYS				ukan da 194		eter hally way.			The Allegan Control
	PUMPS 2600 GPM	1	EA	\$5,943.00	\$5,943.00	24.00	\$1,200.00	. Orași e își bie,	\$1,200.00	\$7,143.00
	GRISWOLD SEPARATOR	1	EA	\$4,750.00	\$4,750.00	8.00	\$400.00		\$400.00	\$5,150.00
	10" BUTTERFLY VALVE	6	EA	\$425.00	\$2,550.00	6.00	\$300.00		\$1,800.00	\$4,350.00
	PRESSURE GAGES	3	EA	\$16.50	\$49.50	0.25	\$12.50		\$37.50	\$87.00
	BALANCING VALVES	1	EA	\$56.00	\$56.00	0.44	\$22.20		\$22.20	\$78.20
	AUTO PURGE VALVE	1	EA	\$1,050.00	\$1,050.00	0.73	\$36.35	. Call dvjetj	\$36.35	\$1,086.35
	1"BALL VALVES	6	EA	\$12.20	\$73.20	0.42	\$21.05		\$126.30	\$199.50
	FLEXIBLE CONNECTOR	3	EA	\$340.00	\$1,020.00	4.50 .	\$225.00	This year that	\$675.00	\$1,695.00
	1-1/2" STRAINERS	2	EA	\$47.00	\$94.00	0.57	\$28.55	a hadi aykarat	\$57.10	\$151.10
	THERMOMETERS	2	EA	\$33.00	\$66.00	0.25	\$12.50		\$25.00	\$91.00
	GAGE COCKS	7	EA	\$12.20	\$85.40	0.42	\$21.05	gasa jingagara	\$147.35	\$232.75
	10" PIPING	400	LF	\$73.00	\$29,200.00	1.50	\$75.00	v dining.	\$30,000.00	\$59,200.00
	3" PIPING	50	LF	\$6.60	\$330.00	0.37	\$18.60		\$930.00	\$1,260.00
	2" VENT PIPING	10	LF	\$4.12	\$41.20	0.26	\$13.10		\$131.00	\$172.20
	1" DRAIN PIPING	15	LF	\$2.18	\$32.70	0.15	\$7.55		\$113.25	\$145.95
-	1-1/2" BALL VALVES	3	EA	\$18.05	\$54.15	0.62	\$30.75		\$92.25	\$146.40
	CHEM FEED PUMP/TAN	1	LS					j jilijing, beljetju.	. U.w. 294	\$2,000.00
	SOLENOID VALVE	1	EA	\$410.00	\$410.00	0.75	\$37.50		\$37.50	\$447.50
	3" BUTTERFLY VALVES	2	EA	\$185.00	\$370.00	2.00	\$100.00		\$200.00	\$570.00
					1 47 2 441					
	TRIPLE DUTY VALVE	1	EA	\$2,208.00	\$2,208.00	8.00	\$400.00		\$400.00	\$2,608.00
	SUCTION DIFFUSER	1	EA	\$2,093.00	\$2,093.00	8.00	\$400.00		\$400.00	\$2,493.00
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Subtotals: \$50,476.15 \$36,830.80 \$89,306.95

Sales Tax: \$0.00 Overhead: 10% \$8,930.70

**Profit:** 10% \$8,930.70

**Subtotal:** \$107,168.34

**Bond:** \$0.00 **Contingency:** 15% \$16,075.25

**Grand Total:** \$123,243.59

E I U CCC L'AMILE.	COE FLW THERMAL STORAGE
Project Number:	930073-0017 ALTERNATIVE IT-4
Date:	August 02, 1995
Prepared By:	GRH
Sheet:	PAGE 3
Department:	MECHANICAL-HVAC

Base Labor Rate:	
City Multiplier:	0%
Effective Labor Rate:	\$50.00

# **ESTIMATE OF CONSTRUCTION COST**

ITEM		MATERIAL		LABOR				MATERIAL/ LABOR	
# DESCRIPTION	QTY.	UNIT	COST/UNIT	TOTAL	HRS/UNIT	COST/UNIT	TOTAL HRS	TOTAL COST	TOTAL
PROJ MAN. /MISC COSTS	1	LS		\$0.00		\$0.00	0.00	\$0.00	\$29,000.00
							e de la la companione de la companione d	January Commencer	1.1
SIESMIC	1	LS		\$0.00		\$0.00	0.00	÷ <b>\$</b> 0.00	\$10,000.00
								18 Jan 19	15.44
CONTROLS	1	LS		\$0.00		\$0.00	0.00	\$0.00	\$120,000.00
							្រុមស្រាក់ឡើង	estada en la como	11.44 ( ) 1.474
BALANCING	1	LS		\$0.00		\$0.00	0.00	\$0.00	\$4,000.00
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									**
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				48.4					
	1							1.44	
								The second	
							garage of granders		

Subtotals: \$0.

\$0.00

0.00 \$0.00 \$163,000.00

Sales Tax: \$0.00

 Overhead:
 10%
 \$16,300.00

 Profit:
 10%
 \$16,300.00

Subtotal:

\$195,600.00

Bond: Contingency: \$0.00 15% \$29,340.00

Grand Total:

\$224,940.00

Project Name:	Ft. Leonardwood Chiller Study - Alt. IT-4				
Project Number: 930073-0017					
Date:	August 17, 1995				
Prepared By:	S. Benway				
Sheet:	1 of 2				
Department:	Electrical				

Base Labor Rate:	\$28.50
City Multiplier (Labor):	114%
Effective Labor Rate:	\$32.55

City Multiplier (Material):	102%
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# ESTIMATE OF CONSTRUCTION COST

	ITEM		MATERIAL		LABOR			MATERIAL/ LABOR		
#	DESCRIPTION	QTY.	UNIT	COST/UNIT	TOTAL	RS/UNI	COST/UNIT	TOTAL HRS	TOTAL COST	TOTAL
	Chiller #1 Replacement				\$0.00		\$0.00	0.00	\$0.00	\$0.00
1	Demolition	1	LOT	n/a	\$0.00	86.64	\$2,820.00	86.64	\$2,820.00	\$2,820.00
2	Shielded, 5kv, #3/0, cu. w	180	L.F.	\$2.75	\$504.00	0.04	\$1.43	7.90	\$257.00	\$761.00
	Cable Termination	12	EA	\$98.23	\$1,200.00	1.23	\$40.00	14.75	\$480.00	\$1,680.01
4	Grounding	1	LOT	n/a	\$0.00	6.15	\$200.00	6.15	\$200.00	\$200.00
5	2 1/2" Rigid Conduit	40	L.F.	\$5.60	\$228.00	0.18	\$5.70	7.01	\$228.00	\$456.00
	2 1/2" Rigid Connector	6	EA.	\$7.86	\$48.00	1.23	\$40.00	7.37	\$240.00	\$288.00
	2 1/2" Conduit Hanger	4	EA	\$9.82	\$40.00	0.61	\$20.00	2.46	\$80.00	\$120.00
	2 1/2" Flex Conduit	5	L.F.	\$2.16	\$11.00	0.23	\$7.60	1.17	\$38.00	\$49.00
9	2 1/2" Flex Connector	2	EA	\$23.58	\$48.00	0.35	\$11.50	0.71	\$23.00	\$71.00
10	5kv Fuse	3	EA	\$294.70	\$900.00	4.82	\$157.00	14.47	\$471.00	\$1,371.00
	2" Elbow	2	EA	\$22.60	\$46.00	0.88	\$28.50	1.75	\$57.00	\$103.00
12	Connection to Equipment	1	LOT	n/a	\$0.00	7.99	\$260.00	7.99	\$260.00	\$260.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
	Chiller #2 Replacement				\$0.00		\$0.00	0.00	\$0.00	\$0.00
13	Demolition	1	LOT	n/a	\$0.00	86.64	\$2,820.00	86.64	\$2,820.00	\$2,820.00
	Shielded, 5kv, #3/0, cu. w	180	L.F.	\$2.75	\$504.00	0.04	\$1.43	7.90	\$257.00	\$761.00
	Cable Termination	12	EA	\$98.23	\$1,200.00	1.23	\$40.00	14.75	\$480.00	\$1,680.01
16	Grounding	1	LOT	n/a	\$0.00	6.15	\$200.00	6.15	\$200.00	\$200.00
	2 1/2" Rigid Conduit	40	L.F.	\$5.60	\$228.00	0.18	\$5.70	7.01	\$228.00	\$456.00
	2 1/2" Rigid Connector	6	EA	\$7.86	\$48.00	1.23	\$40.00	7.37	\$240.00	\$288.00
	2 1/2" Conduit Hanger	4	EA	\$9.82	\$40.00	0.61	\$20.00	2.46	\$80.00	\$120.00
	2 1/2" Flex Conduit	5	L.F.	\$2.16	\$11.00	0.23	\$7.60	1.17	\$38.00	\$49.00
21	2 1/2" Flex Connector	2	EA	\$23.58	\$48.00	0.35	\$11.50	0.71	\$23.00	\$71.00
22	5kv Fuse	3	EA	\$294.70	\$900.00	4.82	\$157.00	14.47	\$471.00	\$1,371.00
23	2" Elbow	2	EA	\$22.60	\$46.00	0.88	\$28.50	1.75	\$57.00	\$103.00
24	Connection to Equipment	1	LOT	n/a	\$0.00	7.99	\$260.00	7.99	\$260.00	\$260.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
	Chilled Water Pump-40hp				\$0.00		\$0.00	0.00	\$0.00	\$0.00
25	#1/0 thwn cu. conductor	150	L.F.	\$1.14	\$173.40	0.02	\$0.65	3.00	\$97.64	\$271.04
26	1 1/4" EMT conduit	40	L.F.	\$1.21	\$49.27	0.08	\$2.60	3.20	\$104.15	\$153.42
	150amp fuse	3	EA	\$29.00	\$88.57	0.20	\$6.51	0.60	\$19.53	\$108.09
28	Connection to Equipment	1	EA	\$20.00	\$20.36	4.00	\$130.19	4.00	\$130.19	\$150.55
	Combo. Starter/Disc.	1	EA	\$1,360.51	\$1,385.00	10.60	\$345.00	10.60	\$345.00	\$1,730.00
	1 1/4" Flex Conduit	5	L.F.	\$1.07	\$5.45	0.11	\$3.71	0.57	\$18.55	\$24.00
	1 1/4" Flex Connector	2	EA	\$6.38	\$12.98	0.20	\$6.51	0.40	\$13.02	\$26.00
32	150amp switch in Panel	1	EA	\$918.38	\$934.91	2.00	\$65.09	2.00	\$65.09	\$1,000.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
33	New 1000kva Transforme	1	EA	\$15,000.0	\$15,270.00	54.25	\$1,765.67	54.25	\$1,765.67	\$17,035.67
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
34	Disposal of existing trans.	1	EA	\$2,946.95	\$3,000.00	30.72	\$1,000.00	30.72	\$1,000.00	\$3,999.99
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
35	New Primary for Trans.	1	LOT	n/a	\$0.00	460.87	\$15,000.00	460.87	\$15,000.00	\$15,000.00

Project Name:	Ft. Leonardwood Chiller Study				
Project Number:	930073-0017				
Date:	August 17, 1995				
Prepared By:	S. Benway				
Sheet:	2 of 2				
Department:	Electrical				

Base Labor Rate:	\$28.50
City Multiplier (Labor):	114%
Effective Labor Rate:	\$32.55

City Multiplier	(Material):	102%

## **ESTIMATE OF CONSTRUCTION COST**

ITEM			МАТЕ	ERIAL	LABOR				MATERIAL/ LABOR	
#	DESCRIPTION	QTY.	UNIT	COST/UNIT	TOTAL	RS/UNI	COST/UNIT	TOTAL HRS	TOTAL COST	TOTAL
	(2) Cond. Water P20hp				\$0.00		\$0.00	0.00	\$0.00	\$0.00
36	#3 thwn cu. conductor	300	L.F.	\$0.55	\$167.66	0.02	\$0.65	6.00	\$195.28	\$362.95
37	1 1/4" EMT conduit	80	L.F.	\$1.21	\$98.54	0.08	\$2.60	6.40	\$208.30	\$306.84
38	80amp fuse	6	EA	\$10.15	\$62.00	0.20	\$6.51	1.20	\$39.06	\$101.05
39	Connection to Equipment	2	EA	\$20.00	\$40.72	4.00	\$130.19	8.00	\$260.38	\$301.10
40	Combo. Starter/Disc.	2	EA	\$852.65	\$1,736.00	7.01	\$228.00	14.01	\$456.00	\$2,191.99
41	1 1/4" Flex Conduit	10	L.F.	\$1.05	\$10.69	0.11	\$3.71	1.14	\$37.10	\$47.79
42	1 1/4" Flex Connector	4	EA	\$6.25	\$25.45	0.20	\$6.51	0.80	\$26.04	\$51.49
43	100amp switch in Panel	2	EA	\$525.45	\$1,069.82	2.00	\$65.09	4.00	\$130.19	\$1,200.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
	(2) Cooling Twr. Fan-30hr	5			\$0.00		\$0.00	0.00	\$0.00	\$0.00
44	#2 thwn cu. conductor	300	L.F.	\$0.55	\$167.66	0.02	\$0.65	6.00	\$195.28	\$362.95
45	1 1/4" EMT conduit	80	L.F.	\$1.21	\$98.54	0.08	\$2.60	6.40	\$208.30	\$306.84
46	120amp fuse	6	EA	\$29.00	\$177.13	0.20	\$6.51	1.20	\$39.06	\$216.19
47	Connection to Equipment	2	EA	\$20.00	\$40.72	4.00	\$130.19	8.00	\$260.38	\$301.10
48	Combo. Starter/Disc.	2	EA	\$1,356.58	\$2,762.00	10.60	\$345.00	21.20	\$690.00	\$3,451.99
49	1 1/4" Flex Conduit	10	L.F.	\$1.07	\$10.89	0.11	\$3.71	1.14	\$37.10	\$48.00
50	1 1/4" Flex Connector	4	EA	\$6.38	\$25.96	0.20	\$6.51	0.80	\$26.04	\$52.00
51	100amp switch in Panel	2	EA	\$918.38	\$1,869.82	2.00	\$65.09	4.00	\$130.19	\$2,000.01
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
$\vdash$					\$0.00		\$0.00	0.00	\$0.00	\$0.00
		İ			\$0.00		\$0.00	0.00	\$0.00	\$0.00
T					\$0.00		\$0.00	0.00	\$0.00	\$0.00
$\vdash$					\$0.00		\$0.00	0.00	\$0.00	\$0.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
$\vdash$					\$0.00		\$0.00	0.00	\$0.00	\$0.00

Subtotals: \$3

\$35,353.54

977.22 \$31,805.53 \$67,159.07

Sales Tax: 0% \$0.00

 Overhead:
 10%
 \$6,715.91

 Profit:
 10%
 \$7,387.50

Subtotal:

\$81,262.47

 Bond:
 0%
 \$0.00

 Contingency:
 10%
 \$8,126.25

**Grand Total:** 

\$89,388.72

a Tolcer Limite.	COE FLW THERMAL STORAGE			
Project Number: 930073-0017 ALTERNATIVE IT-5				
Date:	August 02, 1995			
Prepared By:	GRH			
Sheet:	PAGE 1			
Department:	MECHANICAL-HVAC			

Base Labor Rate:	
City Multiplier:	0%
Effective Labor Rate:	\$50.00

# **ESTIMATE OF CONSTRUCTION COST**

ITEM	MATERI	IAL	LABOR			MATERIAL/ LABOR			
# DESCRIPTION	QTY.	UNIT	COST/UNIT	TOTAL	HRS/UNIT	COST/UNIT	TOTAL HRS	TOTAL COST	TOTAL
ICE TANK	4500	TONS-HRS	\$44.00	\$198,000.00					\$198,000.00
CLG TWR-970 TONS	970	TONS	\$40.00	\$38,800.00	0.13	\$6.25		\$6,062.50	\$44,862.50
HOISTING	1	LS		15/15/20			in the second of		\$8,000.00
ICE MACHINE 520 TONS	520	TON	\$375.00	\$195,000.00	100.00	\$100.00	1	\$52,000.00	\$247,000.00
NIGHT CHILLER 450 TO	450	TON	\$180.00	\$81,000.00	100.00	\$115.00	, A, A,	\$51,750.00	\$132,750.00
						Age Turk			
CHILLED WTR SYSTEM			`					The telephone	********
PUMPS 1440 GPM	1	EA	\$3,803.00	\$3,803.00	18.00	\$900.00		\$900.00	\$4,703.00
							e y e establish	graylêd:	
8" BUTTERFLY VALVES	6	EA	\$345.00	\$2,070.00	5.33	\$266,50		\$1,599.00	\$3,669.00
THERMOMETERS	2	EA	\$33.00	\$66.00	0.25	\$12.50	mgradaggag	<b>\$25.00</b>	\$91.00
PRESSURE GAGES	2	EA	\$16.50	\$33.00	0.25	\$12.50		\$25.00	\$58.00
RELIEF VALVES	1	EA	\$79.00	\$79.00	0.33	\$16.65		\$16.65	\$95.65
1" BALL VALVES	8	EA	\$12.20	<b>\$</b> 97.60	0.42	\$21.05		\$168.40	\$266.00
GAGE COCKS	5	EA	\$12.20	\$61.00	0.42	\$21.05		\$105.25	\$166.25
8" AIR SEPARATOR	1	EA	\$2,525.00	\$2,525.00	8.00	\$400.00	A Section	\$400.00	\$2,925.00
FLEXIBLE CONNECTOR	2	EA	\$232.00	\$464.00	4.00	\$200.00		\$400.00	\$864.00
CHEMICAL POT FEEDER	1	LS		in the second second					\$2,000.00
8" PIPING	400	LF	\$56.00	\$22,400.00	1.26	\$63.15	digital in the city	\$25,260.00	\$47,660.00
2" PIPING	100	LF	\$5.30	\$530.00	0.12	<b>\$</b> 5.90		\$590.00	\$1,120.00
3/4" PIPING	50	LF	\$2.08	\$104.00	0.11	\$5.40		\$270.00	\$374.00
8" INSULATION	400	LF	\$2.23	\$892.00	0.16	\$8.00		\$3,200.00	\$4,092.00
2" INSULATION	100	LF	\$0.80	\$80.00	0.08	\$4.00		\$400.00	\$480.00
3/4" INSULATION	50	LF	\$0.28	\$14.00	0.07	\$3.50	i est inc.	\$175.00	\$189.00
				y Love and the		1 1 1 1 1 1			
150 GAL EXP TANK	1	EA	\$845.00	\$845.00	4.00	\$200.00		\$200.00	\$1,045.00
FILL VALVE ASSEMBLY	1	EA	\$113.00	\$113.00	0.42	\$21.05		\$21.05	\$134.05
MANUAL AIR VENT	1	EA	\$35.00	<b>\$</b> 35.00	0.67	\$33.35		\$33.35	\$68.35
1" STRAINER	1	EA	\$13.75	\$13.75	0.47	<b>\$</b> 23.55		\$23.55	\$37.30
TRIPLE DUTY VALVE	1	EA	\$2,208.00	\$2,208.00	8.00	\$400.00	and the Second	\$400.00	\$2,608.00
SUCTION DIFFUSER	1	EA	\$1,053.00	\$1,053.00	6.00	\$300.00		\$300.00	\$1,353.00

Subtotals: \$550,286.35 \$144,324.75 \$704,611.10

 Sales Tax:
 \$0.00
 Overhead:
 10%
 \$70,461.11

 Profit:
 10%
 \$77,507.22

**Subtotal:** \$852,579.43

 Bond:
 \$0.00

 Contingency:
 15%
 \$127,886.91

**Grand Total:** \$980,466.35

Project Name:	COE FLW THERMAL STORAGE
Project Number:	930073-0017 ALTERNATIVE IT-5
Date:	August 02 1995
Prepared By:	GRH
Sheet:	PAGE 2
Department:	MECHANICAL-HVAC

Base Labor Rate:	
City Multiplier:	0%
Effective Labor Rate:	\$50.00

# **ESTIMATE OF CONSTRUCTION COST**

ITEM			MATERIAL		LABOR				MATERIAL/ LABOR	
#	DESCRIPTION	QTY.	UNIT	COST/UNIT	TOTAL	HRS/UNIT	COST/UNIT	TOTAL HRS	TOTAL COST	TOTAL
					esgrijagi			station include	er gara	
	CONDENSER WTR SYS									
	PUMPS 2328 GPM	1	EA	\$5,773.00	\$5,773.00	24.00	\$1,200.00		\$1,200.00	\$6,973.00
	GRISWOLD SEPARATOR	1	EA	\$4,750.00	\$4,750.00	8.00	\$400.00		\$400.00	\$5,150.00
	10" BUTTERFLY VALVE	6	EA	\$425.00	\$2,550,00	6.00	\$300.00		\$1,800.00	\$4,350.00
	PRESSURE GAGES	3	EA	\$16.50	\$49.50	0.25	\$12.50		\$37.50	\$87.00
	BALANCING VALVES	1	EA	\$56.00	\$56.00	0.44	\$22.20		\$22.20	\$78.20
	AUTO PURGE VALVE	1	EA	\$1,050.00	\$1,050.00	0.73	\$36.35		\$36.35	\$1,086.35
	1"BALL VALVES	6	EA	\$12.20	\$73.20	0.42	\$21.05		\$126.30	\$199.50
	FLEXIBLE CONNECTOR	3	EA	\$340.00	\$1,020.00	4.50	\$225.00		\$675.00	\$1,695.00
	1-1/2" STRAINERS	2	EA	\$47.00	\$94.00	0.57	\$28.55		\$57.10	\$151.10
	THERMOMETERS	2	EA	\$33.00	\$66.00	0.25	\$12.50	adquari bijir P	\$25.00	\$91.00
Н	GAGE COCKS	7	EA	\$12.20	\$85.40	0.42	\$21.05		\$147.35	\$232.75
$\vdash$	10" PIPING	400	LF	\$73.00	\$29,200.00	1.50	\$75.00		\$30,000.00	\$59,200.00
$\vdash$	B" PIPING	50	LF	\$6.60	\$330.00	0.37	\$18.60	estaji dagi kali	\$930.00	\$1,260.00
	2" VENT PIPING	10	LF	\$4.12	\$41.20	0.26	\$13.10	<b>建铁路铁矿</b>	\$131.00	\$172.20
	1" DRAIN PIPING	15	LF	\$2.18	\$32.70	0.15	\$7.55		\$113.25	\$145.95
	1-1/2" BALL VALVES	3	EA	\$18.05	\$54.15	0.62	\$30.75		\$92.25	\$146.40
	CHEM FEED PUMP/TAN	1	EA					, den katika k		\$2,000.00
	SOLENOID VALVE	1	EA	\$410.00	\$410.00	0.75	\$37.50	.da pagar	\$37.50	\$447.50
	3" BUTTERFLY VALVES	2	EA	\$185.00	\$370.00	2.00	\$100.00	i dina 11 ki ji findi. h	\$200.00	\$570.00
					The state of			grago injerêji di	They proced	27.00
$\Box$	TRIPLE DUTY VALVE	1	EA	\$2,208.00	\$2,208.00	8.00	\$400.00	ang maki	\$400.00	\$2,608.00
	SUCTION DIFFUSER	1	EA	\$2,093.00	\$2,093.00	6.00	\$300,00		\$300.00	\$2,393.00
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Subtotals:

\$50,306.15

0.00 \$36,730.80 \$89,036.95

Sales Tax: \$0.00

 Overhead:
 10%
 \$8,903.70

 Profit:
 10%
 \$8,903.70

Subtotal:

\$106,844.34

**Bond:** \$0.00 **Contingency:** 15% \$16,026.65

**Grand Total:** 

\$122,870.99

Project Name:	COE FLW THERMAL STORAGE
Project Number:	930073-0017 ALTERNATIVE IT-5
Date:	August 02, 1995
Prepared By:	GRH
Sheet:	PAGE 3
Department:	MECHANICAL-HVAC

Base Labor Rate:	
City Multiplier:	0%
Effective Labor Rate:	\$50.00

# **ESTIMATE OF CONSTRUCTION COST**

ITEM			MATERI	AL		MATERIAL/ LABOR				
#	DESCRIPTION	QTY.	UNIT	COST/UNIT	TOTAL	HRS/UNIT	COST/UNIT	TOTAL HRS	TOTAL COST	TOTAL
	PROJ MAN/ MISC COSTS	1	LS		\$0.00	1	\$0.00	0.00	\$0.00	\$29,500.00
									Hilpanii — Da	
	SEISMIC	l	LS		\$0.00		\$0.00	0.00	\$0.00	\$10,000.00
	CONTROLS	1	LS		\$0.00		\$0.00	0.00	\$0.00	\$96,750.00
					signature 1.				Thister of this	
	BALANCING	1	LS	·	\$0.00		\$0.00	0.00	\$0.00	\$4,000.00
					Taylin Ha		The House			v sêrsi
					74.5				Make Au	
					the Medical		in Astronas			
							racy of 104 car definitioning			kaastatii
							Tipotyriki,			
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					电视器 经营销					
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					aruyen sa j		The legal			
									. Herri	:
					. Detail		1 - 12 34	r vjernskih.	1 Yuna - 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	
									1.04	

 Subtotals:
 \$0.00
 \$0.00
 \$140,250.00

 Sales Tax:
 \$0.00
 Overhead:
 10%
 \$14,025.00

Profit: 10% \$14,025.00 | 10% \$14,025.00

Subtotal: \$168,300.00

 Bond:
 \$0.00

 Contingency:
 15%
 \$25,245.00

**Grand Total:** \$193,545.00

Project Name:	Ft. Leonardwood Chiller Study - Alt. IT-5				
Project Number: 930073-0017					
Date:	August 17, 1995				
Prepared By:	S. Benway				
Sheet:	1 of 2				
Department:	Electrical				

Base Labor Rate:	\$28.50
City Multiplier (Labor):	114%
Effective Labor Rate:	\$32.55

City Multiplier (Material):	102%
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# ESTIMATE OF CONSTRUCTION COST

ITEM			MATERIAL		LABOR				MATERIAL/ LABOR	
#	DESCRIPTION	QTY.	UNIT	COST/UNIT	TOTAL	RS/UNI	COST/UNIT	TOTAL HRS	TOTAL COST	TOTAL
	Chiller #1 Replacement				\$0.00		\$0.00	0.00	\$0.00	\$0.00
1	Demolition	1	LOT	n/a	\$0.00	86.64	\$2,820.00	86.64	\$2,820.00	\$2,820.00
2	Shielded, 5kv, #3/0, cu. w	180	L.F.	\$2.75	\$504.00	0.04	\$1.43	7.90	\$257.00	\$761.00
3	Cable Termination	12	EA	\$98.23	\$1,200.00	1.23	\$40.00	14.75	\$480.00	\$1,680.01
	Grounding	1	LOT	n/a	\$0.00	6.15	\$200.00	6.15	\$200.00	\$200.00
5	2 1/2" Rigid Conduit	40	L.F.	\$5.60	\$228.00	0.18	\$5.70	7.01	\$228.00	\$456.00
	2 1/2" Rigid Connector	6	EA	\$7.86	\$48.00	1.23	\$40.00	7.37	\$240.00	\$288.00
7	2 1/2" Conduit Hanger	4	EA	\$9.82	\$40.00	0.61	\$20.00	2.46	\$80.00	\$120.00
8	2 1/2" Flex Conduit	5	L.F.	\$2.16	\$11.00	0.23	\$7.60	1.17	\$38.00	\$49.00
9	2 1/2" Flex Connector	2	EA	\$23.58	\$48.00	0.35	\$11.50	0.71	\$23.00	\$71.00
10	5kv Fuse	3	EA	\$294.70	\$900.00	4.82	\$157.00	14.47	\$471.00	\$1,371.00
11	2" Elbow	2	EA	\$22.60	\$46.00	0.88	\$28.50	1.75	\$57.00	\$103.00
12	Connection to Equipment	1	LOT	n/a	\$0.00	7.99	\$260.00	7.99	\$260.00	\$260.00
_					\$0.00		\$0.00	0.00	\$0.00	\$0.00
	Chiller #2 Replacement				\$0.00		\$0.00	0.00	\$0.00	\$0.00
13	Demolition	1	LOT	n/a	\$0.00	86.64	\$2,820.00	86.64	\$2,820.00	\$2,820.00
	Shielded, 5kv, #3/0, cu. w	180	L.F.	\$2.75	\$504.00	0.04	\$1.43	7.90	\$257.00	\$761.00
	Cable Termination	12	EA	\$98.23	\$1,200.00	1.23	\$40.00	14.75	\$480.00	\$1,680.01
	Grounding	1	LOT	n/a	\$0.00	6.15	\$200.00	6.15	\$200.00	\$200.00
	2 1/2" Rigid Conduit	40	L.F.	\$5.60	\$228.00	0.18	\$5.70	7.01	\$228.00	\$456.00
	2 1/2" Rigid Connector	6	EA	\$7.86	\$48.00	1.23	\$40.00	7.37	\$240.00	\$288.00
	2 1/2" Conduit Hanger	4	EA	\$9.82	\$40.00	0.61	\$20.00	2.46	\$80.00	\$120.00
	2 1/2" Flex Conduit	5	L.F.	\$2.16	\$11.00	0.23	\$7.60	1.17	\$38.00	\$49.00
	2 1/2" Flex Connector	2	EA	\$23.58	\$48.00	0.35	\$11.50	0.71	\$23.00	\$71.00
	5kv Fuse	3	EA	\$294.70	\$900.00	4.82	\$157.00	14.47	\$471.00	\$1,371.00
	2" Elbow	2	EA	\$22.60	\$46.00	0.88	\$28.50	1.75	\$57.00	\$103.00
	Connection to Equipment	1	LOT	n/a	\$0.00	7.99	\$260.00	7.99	\$260.00	\$260.00
201	Connection to Equipment	Ė			\$0.00		\$0.00	0.00	\$0.00	\$0.00
	Chilled Water Pump-40hp	$\vdash$	1		\$0.00		\$0.00	0.00	\$0.00	\$0.00
25	#1/0 thwn cu. conductor	150	L.F.	\$1.14	\$173.40	0.02	\$0.65	3.00	\$97.64	\$271.04
	1 1/4" EMT conduit	40	L.F.	\$1.21	\$49.27	0.08	\$2.60	3.20	\$104.15	\$153.42
	150amp fuse	3	EA	\$29.00	\$88.57	0.20	\$6.51	0.60	\$19.53	\$108.09
	Connection to Equipment		EA	\$20.00	\$20.36	4.00	\$130.19	4.00	\$130.19	\$150.55
	Combo. Starter/Disc.	1	EA	\$1,360.51	\$1,385.00	10.60	\$345.00	10.60	\$345.00	\$1,730.00
	1 1/4" Flex Conduit	5	L.F.	\$1.07	\$5.45	0.11	\$3.71	0.57	\$18.55	\$24.00
	1 1/4" Flex Connector	2	EA	\$6.38	\$12.98	0.20	\$6.51	0.40	\$13.02	\$26.00
	150amp switch in Panel	1	EA	\$918.38	\$934.91	2.00	\$65.09	2.00	\$65.09	\$1,000.00
22	, i Joanny Switch in Lanci	<del>                                     </del>	LA	\$7.10.50	\$0.00		\$0.00	0.00	\$0.00	\$0.00
22	New 1000kva Transforme	1	EA	\$15,000,0	\$15,270.00	54.25	\$1,765.67	54.25	\$1,765.67	\$17,035.67
33	pacw 1000kva 11anstorine	1	LA	\$13,000.0	\$0.00	1	\$0.00	0.00	\$0.00	\$0.00
2.4	Diamagal of cuiating trans	1	EA	\$2,946.95	\$3,000.00	30.72	\$1,000.00	30.72	\$1,000.00	\$3,999.99
34	Disposal of existing trans.	1	EA	\$4,740.93	\$0.00	30.72	\$0.00	0.00	\$0.00	\$0.00
	New Primary for Trans.	_	LOT	n/a	\$0.00	460.87	\$15,000.00	460.87	\$15,000.00	\$15,000.00

Project Name:	Ft. Leonardwood Chiller Study				
Project Number:	930073-0017				
Date:	August 17, 1995				
Prepared By:	S. Benway				
Sheet:	2 of 2				
Department:	Electrical				

Base Labor Rate:	\$28.50			
City Multiplier (Labor):	114%			
Effective Labor Rate:	\$32.55			

City Multiplier (Material):	102%
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# ESTIMATE OF CONSTRUCTION COST

ГТЕМ			MATERIAL		LABOR				MATERIAL/ LABOR	
#	DESCRIPTION	QTY.	UNIT	COST/UNIT	TOTAL	RS/UNI	COST/UNIT	TOTAL HRS	TOTAL COST	TOTAL
	Cooling Tower Fan-60hp				\$0.00		\$0.00	0.00	\$0.00	\$0.00
36	#2/0 thwn cu. conductor	150	L.F.	\$1.17	\$178.66	0.03	\$0.98	4.50	\$146.46	\$325.12
37	2" EMT conduit	40	L.F.	\$1.91	\$77.78	0.10	\$3.25	4.00	\$130.19	\$207.96
38	200amp fuse	3	EA	\$22.50	\$68.72	0.22	\$7.23	0.67	\$21.68	\$90.39
39	Connection to Equipment	1	EA	\$300.00	\$305.40	20.00	\$650.94	20.00	\$650.94	\$956.34
40	Combo. Starter/Disc.	1	EA	\$1,943.67	\$1,978.66	16.00	\$520.75	16.00	\$520.75	\$2,499.41
41	2" Flex Conduit	5	L.F.	\$1.80	\$9.16	0.20	\$6.51	1.00	\$32.55	\$41.71
42	2" Flex Connector	2	EA	\$12.30	\$25.04	0.35	\$11.33	0.70	\$22.65	\$47.70
43	200amp switch in Panel	1	EA	\$1,000.00	\$1,018.00	8.00	\$260.38	8.00	\$260.38	\$1,278.38
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
	Cond. Water Pump-25hp				\$0.00		\$0.00	0.00	\$0.00	\$0.00
44	#4 thwn cu. conductor	180	L.F.	\$0.39	\$71.46	0.02	\$0.65	3.60	\$117.17	\$188.63
45	1 1/4" EMT conduit	50	L.F.	\$1.21	\$61.59	0.08	\$2.60	4.00	\$130.19	\$191.78
46	90amp fuse	3	EA	\$10.15	\$31.00	0.20	\$6.51	0.60	\$19.53	\$50.53
	Connection to Equipment	1	EA	\$30.00	\$30.54	4.09	\$133.17	4.09	\$133.17	\$163.71
	Combo. Starter/Disc.	1	EA	\$1,356.58	\$1,381.00	10.60	\$345.00	10.60	\$345.00	\$1,726.00
49	1 1/4" Flex Conduit	5	L.F.	\$1.07	\$5.45	0.11	\$3.58	0.55	\$17.90	\$23.35
50	1 1/4" Flex Connector	2	EA	\$6.38	\$12.99	0.20	\$6.51	0.40	\$13.02	\$26.01
51	100amp switch in Panel	1	EA	\$918.38	\$934.91	2.00	\$65.09	2.00	\$65.09	\$1,000.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
				<u> </u>	\$0.00		\$0.00	0.00	\$0.00	\$0.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00
					\$0.00		\$0.00	0.00	\$0.00	\$0.00

Subtotals:

\$33,180.28

\$0.00

967.63 \$31,493.50 \$64,673.78

Sales Tax: 0%

Overhead: Profit:

10% \$6,467.38 10% \$7,114.12

Subtotal:

\$78,255.28

Bond: Contingency: 0% \$0.00 10% \$7,825.53

**Grand Total:** 

\$86,080.81

## APPENDIX H

# LIFE CYCLE COST ANALYSIS COMPUTER PRINTOUTS

```
__IFE CYCLE COST ANALYSIS SUMMARY STUDY: FLWSTOR ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) LCCID FY95 (92)
INSTALLATION & LOCATION: FORT LEONARD WREGION NOS. 7 CENSUS: 2
PROJECT NO. & TITLE: 930073-0017 COLD THERMAL STORAGE ANALYSIS
FISCAL YEAR 1996 DISCRETE PORTION NAME: ECO IH-1
ANALYSIS DATE: 08-21-95 ECONOMIC LIFE 20 YEARS PREPARED BY: T. J. GRANT
1. INVESTMENT
A. CONSTRUCTION COST $ 769817.
                        $ 95404.
B. SIOH
                 .
$
C. DESIGN COST
                             93171.
D. TOTAL COST (1A+1B+1C) $ 948394.
                                             o.
o.
E. SALVAGE VALUE OF EXISTING EQUIPMENT $
F. PUBLIC UTILITY COMPANY REBATE $
                                                       948394.
G. TOTAL INVESTMENT (1D - 1E - 1F)
2. ENERGY SAVINGS (+) / COST (-)
DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1994
            UNIT COST SAVINGS ANNUAL $ DISCOUNT DISCOUNTED
           $/ MWH(1) MWH/YR(2) SAVINGS(3) FACTOR(4) SAVINGS(5)
    FUEL
                                  $
                                                    15.88
                                                                   4472.
                                           282.
    A. ELECT $ 25.00
                            11.
                                          ō.
                                                                    0.
                                                     19.16 $
    B. DIST $ .00
                            0.
                                     ∌
    C. RESID # .00
                                    $
                                             0.
                                                    21.43 $
                                                                      0.
                             0.
                                                                     O.
                            0.
                                            0.
                                                    18.30 $
                                    $
    D. NAT 6 $ .00
                            0. $ 0.
0. $ 0.
$ 7203.
                                                    16.62 $
18.20 $
                                                                     0.
    E. COAL $ .00
                                                                     0.
    F. PPG $ .00
                                                    14.88 $ 136941.
    M. DEMAND SAVINGS
                          11. $ 9485.
                                                                 141412.
                                                            $
    N. TOTAL
3. NON ENERGY SAVINGS(+) / COST(-)
   A. ANNUAL RECURRING (+/-)
                                                                      0 ,
      (1) DISCOUNT FACTOR (TABLE A)
                                                    14.88
                                                                     0.
       (2) DISCOUNTED SAVING/COST (3A X 3A1)
   B. NON RECURRING SAVINGS(+) / COSTS(-)
                            SAVINGS(+) YR DISCNT DISCOUNTED
COST(-) OC FACTR SAVINGS(+)
                                                       SAVINGS(+)/
               ITEM
                                (1) (2) (3)
                                                       EOST(-)(4)
    d. TOTAL
                            $ 0.
   C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-)(3A2+3Bd4)$
4. FIRST YEAR DOLLAR SAVINGS 2N3+3A+(3Bd1/(YRS ECONOMIC LIFE))$
                                                               99.99 YEARS
5. SIMPLE PAYBACK PERIOD'(16/4)
                                                             s 14:412.
A. TOTAL NET DISCOUNTED SAVINGS (2N5+3C)
                                                                 .15
7. SAVINGS TO INVESTMENT RATIO (SIR)=(6 / 1G)=
    (IF < 1 PROJECT DOES NOT QUALIFY)
                                                              -6.35 %
 8. ADJUSTED INTERNAL RATE OF RETURN (AIRR):
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LIFE CYCLE COST ANALYSIS SUMMARY
                                                   STUDY: FLWSTOR
    ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) LCCID FY95 (92)
INSTALLATION & LOCATION: FORT LEONARD WREGION NOS. 7 CENSUS: 2
PROJECT NO. & TITLE: 930073-0017 COLD THERMAL STORAGE ANALYSIS
FISCAL YEAR 1996 DISCRETE PORTION NAME: ECO IH-2
ANALYSIS DATE: 08-21-95 ECONOMIC LIFE 20 YEARS PREPARED BY: T. J. GRANT
1. INVESTMENT
A. CONSTRUCTION COST $ 1920564.
                           148678.
                       45
R. SIOH
C. DESIGN COST
                        玄
                           162215.
D. TOTAL COST (1A+1B+1C) $ 2231477.
                                            O. ,
E. SALVAGE VALUE OF EXISTING EQUIPMENT $
F. PUBLIC UTILITY COMPANY REBATE $
                                            0.
                                                    2231477.
G. TOTAL INVESTMENT (1D - 1E - 1F)
2. ENERGY SAVINGS (+) / COST (-)
DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1994
            UNIT COST SAVINGS ANNUAL $ DISCOUNT DISCOUNTED
                                              FACTOR(4) SAVINGS(5)
                                    SAVINGS(3)
    FUEL
            $/ MWH(1)
                       MWH/YR(2)
                                                               -83317.
                                        -5247.
                                                   15.88 $
    A. ELECT $ 25.00
                         -210.
                                                                0.
                                        0.,
                                                   19.16 $
    B. DIST $ .00
                                    李
                           0.
                                                                   0.
                                   ್5
                                                   21.43
                                                         $
                                           0...
                           0.
    C. RESID $ .00
                                           O.
                                                   18.30 $
                                                                   () a
    D. NAT G $
                .00
                           O ..
                                   #
                                          0.
                                                                   0.
               .00
                                                  16.62 $
    E. COAL $
                                   45
                           O.,
                                                  18.20 $
                .00
                                   $
                                           0.
                           () <sub>a</sub>
    F. PPG $
                                                   14.88 $ 718957.
                                   $ 48317.
    M. DEMAND SAVINGS
                                                               A35640.
                                  $ 43070.
                          -210.
    N. TOTAL
3. NON ENERGY SAVINGS(+) / COST(-)
                                                                   0.
   A. ANNUAL RECURRING (+/-)
                                                   14.88
       (1) DISCOUNT FACTOR (TABLE A)
                                                                   0.
       (2) DISCOUNTED SAVING/COST (3A X 3A1)
   B. NON RECURRING SAVINGS(+) / COSTS(-)
                           SAVINGS(+) YR DISCNT
COST(-) OC FACTR
                                                     DISCOUNTED
                                                      SAVINGS(+)/
                            COST(-)
               TTEM
                                                      COST(-)(4)
                                             (3)
                                (1)
                                      (2)
                                                             O_{\pi}
                                 0.
    d. TOTAL
   C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-)(3A2+3Bd4)$
4. FIRST YEAR DOLLAR SAVINGS 2N3+3A+(3Bd1/(YRS ECONOMIC LIFE))$ 43070.
                                                            51.81 YEARS
 5. SIMPLE PAYBACK PERIOD (16/4)
                                                             635640.
4. TOTAL NET DISCOUNTED SAVINGS (2N5+3C)
                                                              .28
 7. SAVINGS TO INVESTMENT RATIO (SIR)=(6 / 16)=
    (IF < 1 PROJECT DOES NOT GUALIFY)
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8. ADJUSTED INTERNAL RATE OF RETURN (AIRR);

-3,27 %

LIFE CYCLE COST ANALYSIS SUMMARY ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) LCCID FY95 (92)
INSTALLATION & LOCATION: FORT LEONARD WREGION NOS. 7 CENSUS: 2 PROJECT NO. & TITLE: 930073-0017 COLD THERMAL STORAGE ANALYSIS FISCAL YEAR 1996 DISCRETE PORTION NAME: ECO IH-3 ANALYSIS DATE: 08-21-95 ECONOMIC LIFE 20 YEARS PREPARED BY: T. J. GRANT 1, INVESTMENT A. CONSTRUCTION COST \$ 761083. **\$** \$ 84926. B. SIOH 92647. C. DESIGN COST D. TOTAL COST (1A+1B+1C) \$ 938656. E. SALVAGE VALUE OF EXISTING EQUIPMENT \$
F. PUBLIC UTILITY COMPANY REBATE \$
G. TOTAL INVESTMENT (1D - 1E - 1F) 0. 0., 2. ENERGY SAVINGS (+) / COST (-) DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1994 UNIT COST SAVINGS ANNUAL \$ DISCOUNT DISCOUNTED \$/ MWH(1) MWH/YR(2) SAVINGS(3) FACTOR(4) SAVINGS(5) FHEL -6022.-379. 15.88 A. ELECT \$ 25.00 -15. 0. 0. \$ 19.16 \$ 0. B. DIST \$ .00 0. 21.43 \$ 18.30 \$ 0. \$ C. RESID \$ .00 0 , 0. \$ () , D. NAT G \$ .00 0. 0. \$ 0. 0. \$ 0. \$ 9500. -15. \$ 9121. 0. 16.62 \$ E. COAL \$ .00 18,20 \$ F. PFG \$ .00 14.88 \$ 141360. M. DEMAND SAVINGS **±** 135338. N. TOTAL 3. NON EMERGY SAVINGS(+) / COST(-)  $O_{\mu}$ A. ANNUAL RECURRING (+/-) (1) DISCOUNT FACTOR (TABLE A) 14.88 O., (2) DISCOUNTED SAVING/COST (3A X 3A1) R. NON RECURRING SAVINGS(+) / COSTS(-) SAVINGS(+) YR DISCNT COST(-) DC FACTR DISCOUNTED COST(-) SAVINGS(+)/ ITEM (2) (3) COST(-)(4)(1) $\circ$ . \$ 0. d. TOTAL C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-)(3A2+3Bd4)\$ 4. FIRST YEAR DOLLAR SAVINGS 2N3+3A+(3Bd1/(YRS ECONOMIC LIFE))\$ 9121. 102.91 YEARS 5. SIMPLE PAYBACK PERIOD (16/4) s 135338. A. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) .14 (SIR) = (6 / 10) =7. SAVINGS TO INVESTMENT RATIO (IF < 1 PROJECT DOES NOT QUALIFY) -6.51 % 8. ADJUSTED INTERNAL RATE OF RETURN (AIRF):

STUDY: FLWSTOR

LIFE CYCLE COST ANALYSIS SUMMARY STHDY: FLWSTOR ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) LCCID FY95 (92) INSTALLATION & LOCATION: FORT LEONARD WREGION NOS. 7 CENSUS: 2 PROJECT NO. & TITLE: 930073-0017 COLD THERMAL STORAGE ANALYSIS FISCAL YEAR 1994 DISCRETE PORTION NAME: ECO IH-4 ANALYSIS DATE: 08-21-95 ECONOMIC LIFE 20 YEARS PREPARED BY: T. J. GRANT 1. INVESTMENT A. CONSTRUCTION COST \$ 972958. 96469. R. STOH \$ C. DESIGN COST \$ 105239. D. TOTAL COST (1A+1B+1C) \$ 1174666. E. SALVAGE VALUE OF EXISTING EQUIPMENT \$
F. PUBLIC UTILITY COMPANY REBATE \$ · • 0. 1174666. G. TOTAL INVESTMENT (1D - 1E - 1F) 2. ENERGY SAVINGS (+) / COST (-) DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1994 UNIT COST SAVINGS ANNUAL \$ DISCOUNT DISCOUNTED **≢/ MWH(1)** MWH/YR(2) SAVINGS(3) FACTOR(4) SAVINGS(5) FUEL \$ \$ -5419.15.88 -86061. A. ELECT \$ 25.00 -217. () # 19.16 \$  $\circ$ . . 0 \* B. DIST \$ .00 21.43 \$ 0. # 0.2 C. RESID \$ .00 () " 0. \$ 18.30 \$ 0... D. NAT G \$ .00 0. 16.62 \$ . 0.  $_{H}\left( \left\langle \right\rangle \left( \left\langle \right\rangle \right)$ 0. \$ E. COAL \$ 0. \$ 0 ... 18.20 \$ · • F. PPG \$ .00 14.88 \$ 718957. \$ 48317. M. DEMAND SAVINGS \* 632896 .. -217. \$ 42898. N. TOTAL 3. NON ENERGY SAVINGS(+) / COST(-) 0. \$ A. ANNUAL RECURRING (+/-) 14.88 (1) DISCOUNT FACTOR (TABLE A) 0. (2) DISCOUNTED SAVING/COST (3A X 3A1) B. NON RECURRING SAVINGS(+) / COSTS(-) SAVINGS(+) YR DISCNT COST(-) OC FACTR DISCOUNTED COST(-) SAVINGS(+)/ ITEM EOST(-)(4)(1) (2) (3) 0. O., d. TOTAL \$ C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-)(3A2+3Bd4)\$ 4. FIRST YEAR DOLLAR SAVINGS 2N3+3A+(3Bd1/(YRS ECONOMIC LIFE))\$ 42898. 27.38 YEARS 5. SIMPLE PAYBACK PERIOD (16/4) **\$** 632896. 4. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) , 54 (SIR) = (6 / 16) =7. SAVINGS TO INVESTMENT RATIO (IF < 1 PROJECT DOES NOT QUALIFY)

a. ADJUSTED INTERNAL RATE OF RETURN (AIRR):

-.14 %

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LIFE CYCLE COST ANALYSIS SUMMARY STUDY: FLWSTOR ENERGY CONSERVATION INVESTMENT PROGRAM (ECIF) LCCID: FY95 (92)
INSTALLATION & LOCATION: FORT LEONARD WREGION NOS. 7 CENSUS: 2
PROJECT NO. & TITLE: 930073-0017 COLD THERMAL STORAGE ANALYSIS
FISCAL YEAR 1996 DISCRETE PORTION NAME: ECO IH-5
ANALYSIS DATE: 08-21-95 ECONOMIC LIFE 20 YEARS PREPARED BY: T. J. GRANT
1. INVESTMENT
A. CONSTRUCTION COST $ 877121.
                       $ 91275.
B. SIOH
C. DESIGN COST
                       $
                           99573.
D. TOTAL COST (1A+1B+1C) $ 1067969.
                                           O.,
F. SALVAGE VALUE OF EXISTING EQUIPMENT $
                                           0.
F. PUBLIC UTILITY COMPANY REBATE $
                                                $ 1067969.
G. TOTAL INVESTMENT (1D - 1E - 1F)
2. ENERGY SAVINGS (+) / COST (-)
DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1994
           UNIT COST SAVINGS ANNUAL $ DISCOUNT DISCOUNTED
                       MWH/YR(2) SAVINGS(3) FACTOR(4) SAVINGS(5)
           #/ MWH(1)
    FUEL
                                                             -21615.
                                       -1361.
                                                  15.88
    A. ELECT $ 25.00
                          -54.
                                  5
                                                 19.15 $
                                                                  0.
                                       0.
    B. DIST $ .00
                           0.
                                                                  0.
                                          0.
                                                  21.43 $
               .00
                                  $
    C. RESID $
                           0.
                                                  18.30 $
                                          0.
                                                                 0.
                                  $
    D. NAT 6 $ .00
                           0.
                                  *
                                         0.
                                                 16.62 $
                                                                  0.
               .00
                           O.
    E. COAL $
                                                 18.20 $
                                                                  0.
                                        0.
    F. PPG $ .00
                                  $
                          () a
                         $ 48317.
-54. $ 46956.
                                                 14.88 $ 718957.
    M. DEMAND SAVINGS
                                                         $ 697342.
    N. TOTAL
3. NON EMERGY SAVINGS(+) / COST(-)
                                                                  0.
   A. ANNUAL RECURRING (+/-)
                                                 14.88
       (1) DISCOUNT FACTOR (TABLE A)
                                                                  0.
                                                          本
       (2) DISCOUNTED SAVING/COST (3A X 3A1)
   B. NON RECURRING SAVINGS(+) / COSTS(-)
                          SAVINGS(+) YR DISCNT
                                                    DISCOUNTED
                                                    SAVINGS(+)/
                                     OC FACTR
                            COST(-)
              ITEM
                                                    COST(-)(4)
                                    (2)
                                          (3)
                               (1)
                                                            0.
    d. TOTAL
                               0.
                                                                 O.
   C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-)(3A2+3Bd4)$
4. FIRST YEAR DOLLAR SAVINGS 2N3+3A+(3Bd1/(YRS ECONOMIC LIFE))$ 46956.
                                                           22.74 YEARS
 5. SIMPLE PAYBACK PERIOD (16/4)
                                                          $ 697342.
 4. TOTAL NET DISCOUNTED SAVINGS (2N5+3C)
7. SAVINGS TO INVESTMENT RATIO (SIR)=(6 / 1G)=
                                                              .65
    (IF < 1 PROJECT DOES NOT GUALIFY)
                                                              183 %
 8. ADJUSTED INTERNAL RATE OF RETURN (AIRR):
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LIFE CYCLE COST ANALYSIS SUMMARY STUDY: FLWSTOR ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) LOCID FY95 (92) INSTALLATION & LOCATION: FORT LEONARD WREGION NOG. 7 CENSUS: 2 PROJECT NO. & TITLE: 930073-0017 COLD THERMAL STORAGE ANALYSIS FISCAL YEAR 1994 DISCRETE PORTION NAME; ECO IT-1 ANALYSIS DATE: 08-21-95 ECONOMIC LIFE 20 YEARS PREPARED BY: T. J. GRANT 1. INVESTMENT A. CONSTRUCTION COST 400815. 65060. **±** B. SICH 70974. C. DESIGN COST \$ D. TOTAL COST (1A+1B+1C) \$ 536849. 0. E. SALVAGE VALUE OF EXISTING EQUIPMENT \$ F. PUBLIC UTILITY COMPANY REBATE \$ O. 536849. G. TOTAL INVESTMENT (1D - 1E - 1F) 2. ENERGY SAVINGS (+) / COST (-) DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1994 UNIT COST SAVINGS ANNUAL \$ DISCOUNT DISCOUNTED MWH/YR(2) SAVINGS(3) FACTOR(4) SAVINGS(5) \$/ MWH(1) FUEL 4472. 15.88 282. # A. ELECT \$ 25.00 11. 0. O . 19.16 \$ 95 B. DIST \$ .00 0. 0. 21.43 \$ 0. .00  $\circ$ C. RESID \$ 0. () " 18.30 \$ \$ .00 Ο. D. NAT G \$ 16.62 \$ 0. 35 0. 0. F. COAL \$ .00 0. 0. 18.20 \$ \$ F. PPG \$ .00 0. 221980. 14.88 \$ **s** 14918. M. DEMAND SAVINGS 226452. 11. \$ 15200. N. TOTAL 3. NON ENERGY SAVINGS(+) / COST(-) 0. A. ANNUAL RECURRING (+/-) 14.88 (1) DISCOUNT FACTOR (TABLE A) 0. (2) DISCOUNTED SAVING/COST (3A.X 3A1) B. NON RECURRING SAVINGS(+) / COSTS(-) DISCOUNTED SAVINGS(+) YR DISCNT FACTR SAVINGS(+)/ 00 COST(-) ITEM COST(-)(4)(2) (3) (1)() " d. TOTAL C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-)(3A2+3Bd4)\$ 4. FIRST YEAR DOLLAR SAVINGS 2N3+3A+(38d1/(YRS ECONOMIC LIFE))\$ 15200. 35.32 YEARS 5. SIMPLE PAYBACK PERIOD'(16/4) 226452. 6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) .42 (SIR)=(6 / 1G)= 7. SAVINGS TO INVESTMENT RATIO (IF < 1 PROJECT DOES NOT QUALIFY)

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR):

-1.35 %

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LIFE CYCLE COST ANALYSIS SUMMARY STUDY: FLWSTOP
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) LCCID FY95 (92)
INSTALLATION & LOCATION: FORT LEONARD WREGION NOS. 7 CENSUS: 2
PROJECT NO. & TITLE: 930073-0017 COLD THERMAL STORAGE ANALYSIS
FISCAL YEAR 1996 DISCRETE PORTION NAME: ECO IT-2
ANALYSIS DATE: 08-21-95 ECONOMIC LIFE 20 YEARS PREPARED BY: T. J. GRANT
1. INVESTMENT
A. CONSTRUCTION COST $ 500510.
B. SIOH
C. DESIGN COST
                           $
                                70543.
                                76956.
                           ±
D. TOTAL COST (1A+18+1C) $ 648009.
                                                  0.
E. SALVAGE VALUE OF EXISTING EQUIPMENT $
                                                   0.
F. PUBLIC UTILITY COMPANY REBATE $
                                                             648009.
G. TOTAL INVESTMENT (1D - 1E - 1F)
2. ENERGY SAVINGS (+) / COST (-)
DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1994
             UNIT COST SAVINGS ANNUAL $ DISCOUNT DISCOUNTED
                           MWH/YR(2) SAVINGS(3) FACTOR(4) SAVINGS(5)
             $/ MWH(1)
    FHEL
                           74. $ 1853.
                                                                         29425.
                                                         15,88 $

    74.
    $ 1853.
    15.88 $ 29426.

    0.
    $ 0.
    19.16 $ 0.

    0.
    $ 0.
    21.43 $ 0.

    0.
    $ 0.
    18.30 $ 0.

    0.
    $ 0.
    16.62 $ 0.

    0.
    $ 0.
    18.20 $ 0.

    $ 18110.
    14.88 $ 269477.

    74.
    $ 19963.
    $ 298903.

    A. ELECT $ 25.00
     B. DIST $ .00
                 .00
    C. RESID $
     D. NAT 6 $ .00
    E. COAL $ .00
F. PPG $ .00
    M. DEMAND SAVINGS
     N. TOTAL
3. NON ENERGY SAVINGS(+) / COST(-)
                                                                            O.
                                                                   $
    A. ANNUAL RECURRING (+/-)
        (1) DISCOUNT FACTOR (TABLE A)
                                                          14.88
                                                                            0.
        (2) DISCOUNTED SAVING/COST (3A X 3A1)
    B. NON RECURRING SAVINGS(+) / COSTS(-)
                               SAVINGS(+) YR DISCNT DISCOUNTED
                                                              SAVINGS(+)/
                                            OC FACTR
                                 COST(-)
                 ITEM
                                   (1) (2) (3)
                                                             COST(-)(4)
                                                                     0.
                               $ 0.
    d. TOTAL
    C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-)(3A2+3Bd4)$
 4. FIRST YEAR DOLLAR SAVINGS 2N3+3A+(3Bd1/(YRS ECONOMIC LIFE))$ 19963.
                                                                     32.46 YEARS
 5. SIMPLE PAYBACK PERIOD (1G/4)
                                                                  $ 298903.
 6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C)
 7. SAVINGS TO INVESTMENT RATIO (SIR)=(6 / 18)=
                                                                        .46
    (IF < 1 PROJECT DOES NOT QUALIFY)
                                                                       -,91 %
 8. ADJUSTED INTERNAL RATE OF RETURN (AIRR):
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LIFE CYCLE COST ANALYSIS SUMMARY STUDY: FLWSTOR ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) LCCID FY93 (92)
INSTALLATION & LOCATION: FORT LEGNARD WREGION NOS. 7 CENSUS: 2
PROJECT NO. & TITLE: 930073-0017 COLD THERMAL STORAGE ANALYSIS
FISCAL YEAR 1996 DISCRETE PORTION NAME: ECO IT-3
ANALYSIS DATE: 08-21-95 ECONOMIC LIFE 20 YEARS PREPARED BY: T. J. GRANT
1. INVESTMENT
A. CONSTRUCTION COST $ 859365.
B. SIOH
C. DESIGN COST
                           90423.
                      $
                           98643.
D. TOTAL COST (1A+1B+1C) $ 1048431.
E. SALVAGE VALUE OF EXISTING EQUIPMENT *
                                           0.
F. PUBLIC UTILITY COMPANY REBATE $
                                           \circ .
                                                $ 1048431.
G. TOTAL INVESTMENT (1D - 1E - 1F)
2. ENERGY SAVINGS (+) / COST (-)
DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1994
           UNIT COST SAVINGS ANNUAL $ DISCOUNT DISCOUNTED
           $/ MWH(1) MWH/YR(2) SAVINGS(3) FACTOR(4) SAVINGS(5)
    FUEL
                                       235.
                                                              3727.
                                                 15,88 $
                     9. $
    A. ELECT $ 25.00
                                                 19.16 $
                                                              0.
                                       0.
                          0.
                                  $
    B. DIST $ .00
                                                                \circ
                          0.
                                         0.
                                                 21,43 $
                                 $5
    C. RESID $
                .00
                         o.
o.
                                                                () "
                                                 18.30 $
                                 $
                                         \circ .
    D. NAT 6 $ .00
                                       0.
                                                16.62 $
18.20 $
                                  *
    E. COAL $ .00
                                                                O.,
    F. PPG $ .00
                                 $
                                                14.88 $ 718957.
                                  $ 48317.
    M. DEMAND SAVINGS
                                                        s 722684.
                           φ. $ 48552.
    N. TOTAL
3. NON ENERGY SAVINGS(+) / COST(-)
                                                                 0.
                                                        $
   A. ANNUAL RECURRING (+/-)
      (1) DISCOUNT FACTOR (TABLE A)
                                                 14,88
                                                                0.
       (2) DISCOUNTED SAVING/COST (3A X 3A1)
   B. NON RECURRING SAVINGS(+) / COSTS(-)
                          SAVINGS(+) YR DISCNT
                                                   DISCOUNTED
                                                   SAVINGS(+)/
                            COST(-)
                                          FACTR
                                     90
              ITEM
                                    (2) (3)
                                                   COST(-)(4)
                              (1)
                                                           0.
                          s 0.
   d. TOTAL
   C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-)(3A2+3Bd4)$
4. FIRST YEAR DOLLAR SAVINGS 2N3+3A+(3Bd1/(YRS ECONOMIC LIFE))$ 48552.
                                                          21.59 YEARS
5. SIMPLE PAYBACK PERIOD (16/4)
                                                        $ 722694.
4. TOTAL NET DISCOUNTED SAVINGS (2N5+3C)
                                                            .69
7. SAVINGS TO INVESTMENT RATIO (SIR)=(6 / 16)=
    (IF < 1 PROJECT DOES NOT QUALIFY)
                                                          1.10 %
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8. ADJUSTED INTERNAL RATE OF RETURN (AIRR):

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STUDY: FLWSTOR
         LIFE CYCLE COST ANALYSIS SUMMARY
    ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) LCCID FY95 (92)
INSTALLATION & LOCATION: FORT LEONARD WRESION NOS. 7 CENSUS: 2
PROJECT NO. & TITLE: 930073-0017 COLD THERMAL STORAGE ANALYSIS
FISCAL YEAR 1995 DISCRETE PORTION NAME; ECO IT-4
ANALYSIS DATE: 08-21-95 ECONOMIC LIFE 20 YEARS PREPARED BY: T. J. GRANT
1. INVESTMENT
A. CONSTRUCTION COST $ 787991.
                           85433.
B. SIOH
                       $
                            94290.
C. DESIGN COST
D. TOTAL COST (1A+1B+1C) $ 968714.
                                           O_{a}
E. SALVAGE VALUE OF EXISTING EQUIPMENT $
                                           \circ .
F. PUBLIC UTILITY COMPANY REBATE $
                                                    968714.
G. TOTAL INVESTMENT (1D - 1E - 1F)
2. ENERGY SAVINGS (+) / COST (-)
DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1994
           UNIT COST SAVINGS ANNUAL $ DISCOUNT DISCOUNTED
   FUEL $/ MWH(1) MWH/YR(2) SAVINGS(3) FACTOR(4) SAVINGS(5)
                                                              16506.
                                        1039.
                                                 15,88 $
    A. ELECT $ 25.00
                        . AZ.
                                                              0.
                                        0.
                                                 19.16 $
    B. DIST $ .00
                                  $
                           0.
                                                                 0.
                                  $5
                                          0.
                                                 21.43 $
                           0.
    C. RESID $
               .00
                                                 18.30 $
                                  $
                                                                 0.
                                          \circ .
               .00
                          () #
    D. NAT G $
                                                                 0.
                                                 16.62 $
                                          0,
                ...
                           0.
    E. COAL $
                                                                 5)
                                                 18.20 $
                                  $
                                          () ,
    F. PPG $
                           \circ .
               .00
                                                 14.88 $ 718957.
                                  玉
                                      48317.
    M. DEMAND SAVINGS
                                                         42 .
                                       49356.
                                  害
    N. TOTAL
A. NON ENERGY SAVINGS(+) / COST(-)
                                                                  0.
   A. ANNUAL RECURRING (+/-)
                                                 14.88
      (1) DISCOUNT FACTOR (TABLE A)
                                                                  0.
       (2) DISCOUNTED SAVING/COST (3A X 3A1)
   B. NON RECURRING SAVINGS(+) / COSTS(-)
                                                    DISCOUNTED
                          SAVINGS(+) YR DISCNT
                                                    SAVINGS(+)/
                                     OC
                                           FACTR
                            COST(-)
              ITEM
                                           (3)
                                                    COST(-)(4)
                                     (2)
                               (1)
                                                           0.
    d. TOTAL
                                \circ .
   C. TOTAL NOW EMERSY DISCOUNTED SAVINGS(+)/CDST(-)(3A2+3Bd4)$
                                                             49355.
4. FIRST YEAR DOLLAR SAVINGS 2N3+3A+(3Bd1/(YRS ECONOMIC LIFE))$
                                                           19.63 YEARS
5. SIMPLE PAYBACK PERIOD (16/4)
                                                         5 735463.
6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C)
7. SAVINGS TO INVESTMENT RATIO (SIR)=(6 / 1G)=
                                                             .76
    (IF < 1 PROJECT DOES NOT SUALIFY)
                                                            1.59 %
```

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR):

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LIFE CYCLE COST ANALYSIS SUMMARY
                                                    STUDY: FLWSTOR
    ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)
                                                    LCCID FY95 (92)
INSTALLATION & LOCATION: FORT LEONARD WREGION NOS. 7 CENSUS: 2
PROJECT NO. & TITLE: 930073-0017 COLD THERMAL STORAGE ANALYSIS
FISCAL YEAR 1996 DISCRETE PORTION NAME: ECO IT-5
ANALYSIS DATE: 08-21-95 ECONOMIC LIFE 20 YEARS PREPARED BY: T. J. GRANT
1. INVESTMENT
                        $ 599942.
A. CONSTRUCTION COST
                             76076.
R. SIOH
                             82992.
C. DESIGN COST
                        #
D. TOTAL COST (1A+1B+1C) $ 759010.
                                             0.
E. SALVAGE VALUE OF EXISTING EQUIPMENT $
                                             0.
F. PUBLIC UTILITY COMPANY REBATE $
                                                      759010.
G. TOTAL INVESTMENT (1D - 1E - 1F)
2. ENERGY SAVINGS (+) / COST (-)
DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1994
           UNIT COST SAVINGS ANNUAL $ DISCOUNT DISCOUNTED
                                    SAVINGS(3) FACTOR(4) SAVINGS(5)
    FUEL
           $/ MWH(1)
                        MWH/YR(2)
                                                                 19954.
                                                    15.88
                                                           $
    A. ELECT $ 25.00
                                          1257.
                         50.
                                     $
                                                                   Ο.
                                                    19.16 $
                .00
                                           () "
    B. DIST $
                            \circ.
                                                    21.43 $
                                                                    0.
                                            0.
                                    $
    C. RESID $
                .00
                             O_{a}
                                                                    0.
                                                    18.30 $
                                            O_{a}
                            0.
                                    $
    D. NAT G $
                .00
                                           _{\cdot} \circ .
                                                    16.62
                                                           $
                                                                    \circ
                                    35
                .00
                            O.,
    E. COAL $
                                                                    0.
                                                   18.20 $
                                            \circ .
                                    *
    F. PPG $
                            O_{\pi}
                .00
                                                                718957.
                                                    14.88 $
    M. DEMAND SAVINGS
                                    $
                                         48317.
                                                                738911.
                            50.
                                       49574.
                                                           #
    N. TOTAL
3. NON ENERGY SAVINGS(+) / COST(-)
                                                                    0.
   A. ANNUAL RECURRING (+/-)
                                                    14.88
       (1) DISCOUNT FACTOR (TABLE A)
                                                                    0.
       (2) DISCOUNTED SAVING/COST (3A X 3A1)
   B. NON RECURRING SAVINGS(+) / COSTS(-)
                           SAVINGS(+) YR DISCNT
                                                       DISCOUNTED
                                            FACTR
                                                       SAVINGS(+)/
               ITEM
                             COST(-)
                                      00
                                             (3)
                                                       EOST(-)(4)
                                (1)
                                      (2)
                                                              \circ .
                                 0.
    d. TOTAL
   C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-)(3A2+3Bd4)$
                                                                    0.
                                                               49574.
4. FIRST YEAR DOLLAR SAVINGS 2N3+3A+(3Bd1/(YRS ECONOMIC LIFE))$
                                                              15.31 YEARS
5. SIMPLE PAYBACK PERIOD (16/4)
                                                           5 733911.
6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C)
                                                               .97
7. SAVINGS TO INVESTMENT RATIO (SIR)=(6 / 1G)=
    (IF < 1 PROJECT DOES NOT QUALIFY)
                                                               2.84 %
8. ADJUSTED INTERNAL RATE OF RETURN (AIRF):
```